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(NASA-CR-111233) GEMINI DESIGN APPROVAL TEST PROGRAM. VOLUME 2 - THRUST CHAMBER ASSEMBLIES. BOOK 2 - TWENTY-FIVE POUND-THRUST OAMS TCA P/N 208160-61 FINAL REPORT (Rocketdyne) 452 p

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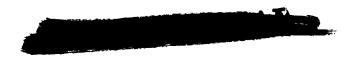
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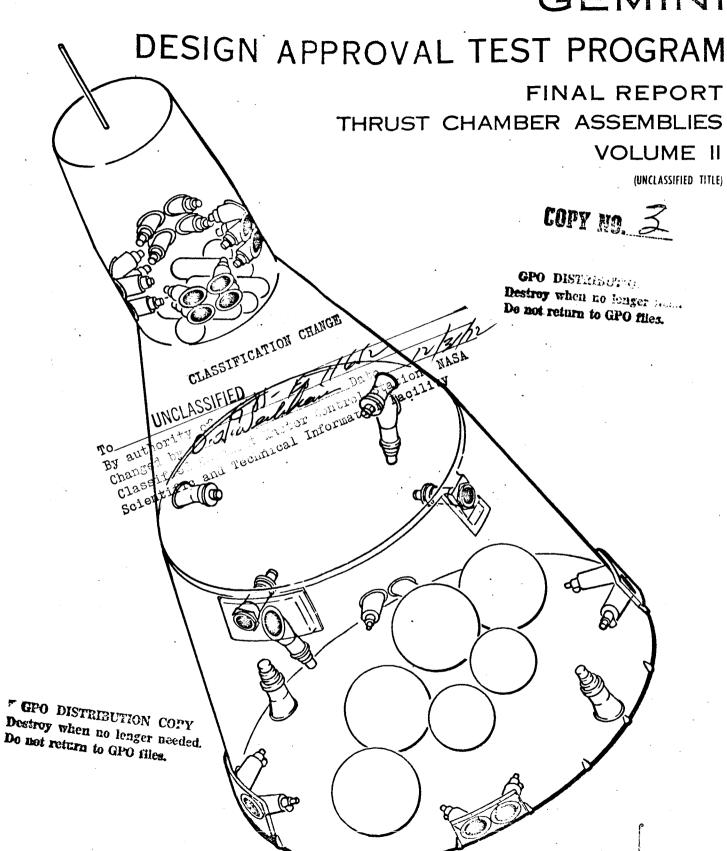
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GEMINI DESIGN APPROVAL TEST PROGRAM
FINAL REPORT, THRUST CHAMBER ASSEMBLIES
VOLUME II, BOOK 2
25-POUND-THRUST OAMS TCA

P/N 208160-61

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#### FOREWORD

This report on the Design Approval Testing of the Gemini 25-pound-thrust OAMS thrust chamber assembly P/N 208160-61 was prepared for the McDonnell Aircraft Corporation in accordance with the requirements of Purchase Order Y20161R.

#### ABSTRACT

The Design Approval Test program conducted on the Gemini 25-pound-thrust OAMS thrust chamber assembly is described. Test data, photographs of test equipment, and test summaries are included.

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### 1.1

#### INTRODUCTION AND SUMMARY

The Design Approval Test program for the Gemini 25-pound-thrust, Orbit Attitude and Maneuver System (OAMS) Thrust Chamber Assembly (TCA) was conducted in compliance with McDonnell Aircraft Corporation Purchase Order Y20161R.

The objective of the Design Approval Test (DAT) program was to demonstrate compliance of the 25-pound-thrust OAMS TCA with the requirements of McDonnell Aircraft Corporation Specification Control Drawing 52-52701 by conducting a planned series of environmental and operating tests on three Thrust Chamber Assemblies. These TCA's were designated as Units 1, 2, and 3 for purposes of identification during the program.

Each of the three test units was subjected to all of the tests as required by the test specification and each demonstrated compliance with all test specification requirements except as indicated below.

During the Mission Duty Cycle tests conducted on Units 1 and 3, the throat station shell temperatures exceeded the specification limit of 550 F. These failures were reported in OFR (FAR) 12917R and OFR (FAR) 12954R (Appendix B), respectively. In no case was there any performance degradation or incipient mechanical failure observed. Each TCA successfully completed the Mission Duty Cycle test.

During the propellant resistance test conducted on the propellant valves from Unit 1, the oxidizer valve failed to open. This failure was reported in OFR (FAR) 12895R (Appendix B). Failure analysis revealed the failure was the result of a test facility electrical wiring problem and that the valve was operating properly.

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During a facility checkout test conducted as part of the impulse-signal width test on Unit 2, the oxidizer valve opened approximately 15 milliseconds after the fuel valve opened. This failure was reported in OFR (FAR) 32656R (Appendix B). Failure analysis revealed corrosion and contamination of the oxidizer valve armature and bore as a result of inadequacies in the decontamination procedure. The decontamination procedure used during subsequent DAT TCA testing was revised to prevent a recurrence of this failure.

During the low-temperature (15 F) impulse-signal width test conducted on Unit 2, the oxidizer propellant valve failed to open. This failure was reported in OFR (FAR) 12924R (Appendix B). Failure analysis revealed the failure to have been caused by frozen propellant resulting from inadequately controlled environmental temperature. The test was subsequently satisfactorily completed on this unit.

A thorough evaluation of the performance characteristics of the 25-pound-thrust OAMS TCA was conducted prior to initiation of the DAT program and continued as additional data were generated during the program. The results of this evaluation indicated that the performance of the TCA did not conform to the specification requirements relative to the shut-down time requirement (7 milliseconds maximum from off signal to 2 percent of thrust) and the specific impulse requirement at the minimum impulse pulse (235 seconds minimum at a 0.25 lb-sec impulse).

As a result of this evaluation, Engineering Change Notice ECN-NA-SE7-289Rl was submitted to the customer by Rocketdyne recommending that the TCA shutdown requirement be changed from a maximum shutdown time to a maximum shutdown impulse and proposing a maximum shutdown impulse of 0.26 lb-sec. Shutdown impulse is the only significant measurable parameter which describes the shutdown performance of a TCA.



The recommendation relative to the revision of this requirement is incorporated in Appendix D of this DAT report. All pages reflecting this change are appropriately identified. Units 1, 2, and 3 all exhibited performance within this requirement.

The pulse specific impulse of this TCA as demonstrated during tests conducted prior to and during the DAT program does not conform to the specification requirements. However, the specification requires that the pulse specific impulse be demonstrated at the minimum impulse pulse (0.25 lb-sec). Operating the TCA in a pulse mode consisting of pulses of the magnitude of the minimum impulse pulse is not representative of the pulse mode operation anticipated during flight. Mission duty cycle test requirements for the 25-pound-thrust OAMS TCA (MAC MDC OCA-113), which represented the best estimate of expected TCA mission operating requirements, indicate that all of the required TCA pulses which provide an impulse of less than 1.0 lb-sec contribute only approximately 12 percent of the TCA MDC burn time to guaranteed life. The TCA specific impulse for the longer duration pulses is considerably higher than that for the shorter. 0.25 lb-sec impulse pulses, because of the geometry of the TCA injector and propellant valve to injector feed tubes. The electrical signal width-specific impulse characteristics for this TCA are as shown on page 357 (Appendix D). This TCA performance data was obtained using the most advanced instrumentation of this type available.

It is therefore concluded that compliance of the 25-pound-thrust QAMS Thrust Chamber Assembly with specification requirements was demonstrated to the extent necessary to satisfy mission objectives by the Design Approval Test program.

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# DESCRIPTION OF 25-POUND\_THRUST OAMS THRUST CHAMBER ASSEMBLY P/N 208160-61

The SE-7 25-pound-thrust Orbit Attitude and Maneuver System (OAMS) Thrust Chamber Assembly (TCA) is a storable liquid, bipropellant, pressure-fed, ablation-cooled assembly (Fig. 1 and 2). Eight TCA's of this configuration are used in the Orbit Attitude and Maneuver System for pitch, yaw, and roll control of the Gemini spacecraft while in earth orbit. Thrust level and propellant mixture ratio are controlled by fixed orifices located at the propellant valve inlets. The propellants used are nitrogen tetroxide (NTO) as the oxidizer and monomethylhydrazine (MMH) as the fuel.

The thrust chamber core is made in two segments: the combustion zone segment and the nozzle segment. The combustion zone segment is fabricated from 90-degree-oriented (perpendicular to the TCA centerline) resinimpregnated, high-silica ablative material. The nozzle segment is fabricated from zero-degree-oriented (parallel to the TCA centerline), resinimpregnated, high-silica ablative material. In addition, the thrust chamber core is wrapped with a layer of phenolic-bonded asbestos fiber to provide additional sealing capabilities. The bond line between the combustion chamber segment and the nozzle segment is located in a low-pressure, low-stress area aft of the throat insert.

Structural support for the thrust chamber body assembly is provided by layers of high-temperature, high-strength glass cloth and filament-wound glass roving bonded by phenolic resin. Additional layers of glass roving provide added strength in the injector attachment and throat areas. The combustion chamber of the TCA contains a seven-piece segmented JTA graphite liner "backed up" by a zero-degree ablative material sleeve. A throat



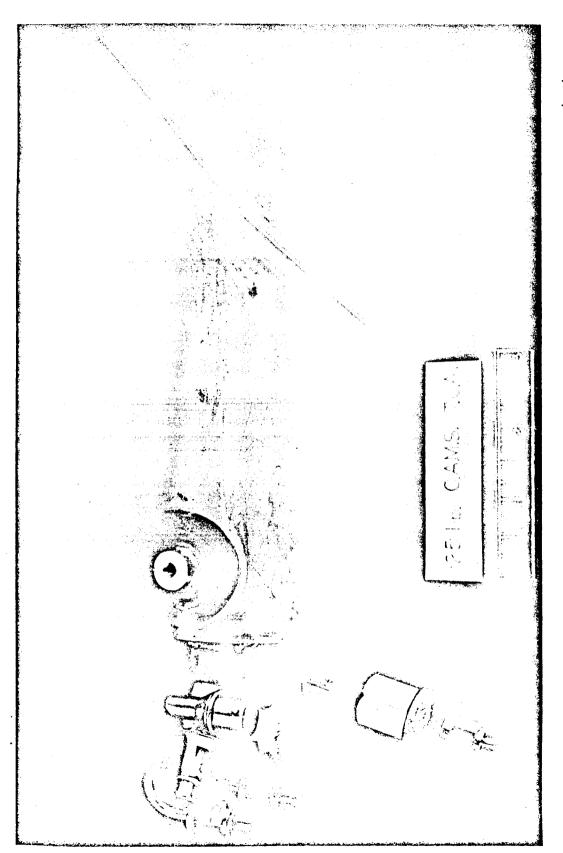


Figure 1. 25-Pound-Thrust OAMS Thrust Chamber Assembly, P/N 208160-61

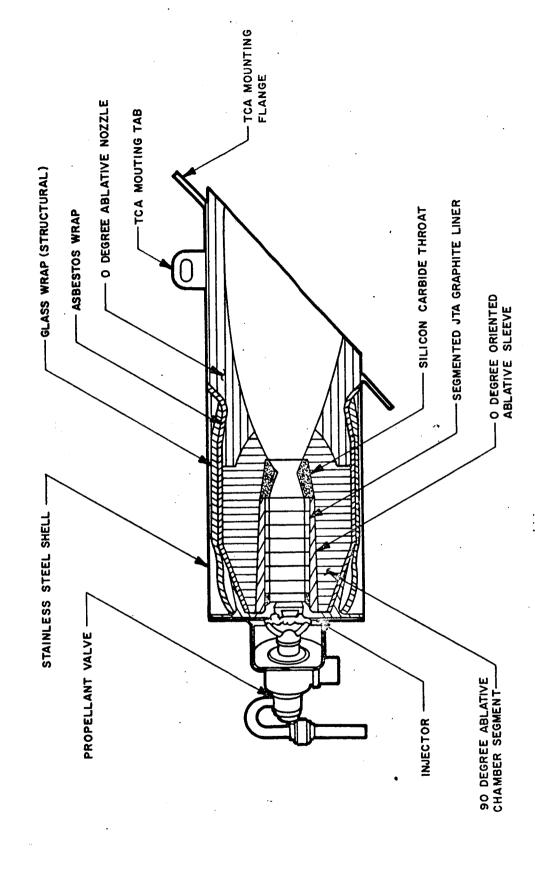


Figure 2. 25-Pound-Thrust OAMS TCA Schematic

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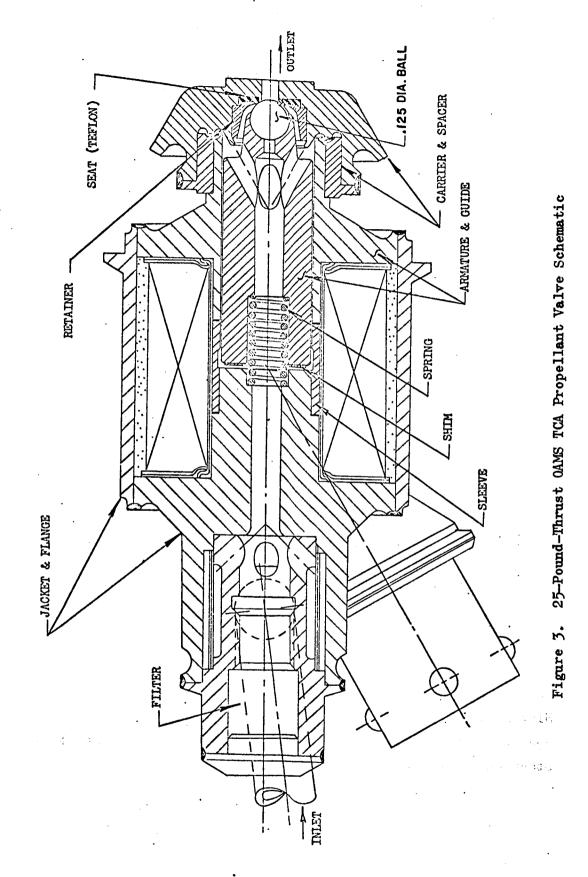
insert of solid silicon carbide is used to resist the erosive effects of the high-temperature combustion gases. The thrust chamber body assembly is encased in a stainless-steel shell to provide structural attachment between the thrust chamber and the spacecraft.

The thrust chamber injector is fabricated from stainless steel. The injector incorporates four pairs of unlike doublets which impinge on a splash plate providing propellant mixing for high combustion efficiency.

TCA operation is controlled by two fast—acting, electrically operated, solenoid propellant valves (Fig. 3). These valves are attached to a mounting bracket which is in turn attached to the injector plate. The basic propellant valve design embodies a hermetically sealed solenoid. Valve sealing is accomplished through the use of a precision ground ball, attached to the armature, which engages a Teflon seat in the closed position. A metal stop below the Teflon seat is incorporated to limit the armature stroke. Closing is accomplished through the use of a spring, and scaling force is obtained from the spring and the pressure of propellant acting on the ball.

The physical and performance data for this TCA are presented in Table 1.





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#### TABLE 1

### 25-POUND-THRUST OAMS TCA P/N 208160-61 PHYSICAL AND PERFORMANCE DATA

Compliance of the Gemini 25-pound-thrust 0AMS TCA P/N 208160-61 with the following physical and performance requirements has been verified by design approval tests.

#### Physical Data

Envelope, inches

overall dimensions: length 10.9, forward OD 2.83, and aft OD 2.83

Weight, Nominal, pounds

Compatibility.

3.02

Nitrogen tetroxide and monomethylhydrazine

#### Materials

Valve parts, Internal Exposed Injector

Thrust Chamber Core

Structural Shell and Brackets

CRES and Teflon

Type 321 CRES

Ablative and ceramic

Type 321 CRES

#### Performance Data

Propellants

nitrogen tetroxide (oxidizer) and

monomethylhydrazine (fuel)

23.0

132

1.30

Classified (see page 11 )

25

Thrust, Vacuum, Rated, pounds

Chamber Pressure, Nominal, psia

Mixture Ratio, Rated, o/f

Specific Impulse

Start time, Maximum, milliseconds

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TABLE I

(Continued)

Performance

Specific Impulse, Nominal, seconds\* 259

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<sup>\*</sup>Classified Parameter



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#### TABLE 1

#### (Concluded)

| Performance Data  |                        |  |  |
|---|------------------------|--|--|
| Shutdown Impulse, Maximum, 1b-sec   | 0,260                  |  |  |
| Oxidizer Inlet Pressure, Rated, psia  | 292                    |  |  |
| Fuel Inlet Pressure, Rated, psia  | 292                    |  |  |
| Life, Specification Performance, MAC<br>Mission Duty Cycle OCA 113, seconds | 118                    |  |  |
| Life, Guaranteed MAC Mission Duty<br>Cycle OCA 113, seconds                 | 160                    |  |  |
| Propellant Valve Service Life,<br>Cycles 1                                  | 50,000                 |  |  |
| Propellant Valve Voltage, Nominal, vdc                                      | 26.0~                  |  |  |
| Propellant Valve Current, Nominal, amps                                     | 0.619                  |  |  |
| Environmental Temperature Range,<br>Operating, F                            | 15 to 200              |  |  |
| Environmental Temperature Shock<br>Range, Nonoperating, F                   | -40 F to +185          |  |  |
| Vibration Level Random, g   | 7.5                    |  |  |
| Shock Level (in shipping container), g                                      | 15 for 11 milliseconds |  |  |
| Proof Pressure, psig  | 392                    |  |  |
|   |                        |  |  |

(1) This requirement was verified using a 25-pound-thrust RCS DAT TCA as reported in Rocketdyne Report R-15019-2, Volume II, Book 1



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#### TEST PROGRAM

#### TEST SEQUENCE

TCA Units 1, 2, and 3 were subjected to the tests outlined below in the order listed.

#### Unit 1

- 1. Visual Inspection
  - a. Component Modification
- 2. Vibration Test
  - a. Propellant Valve Proof Pressure and Leakage
  - b. Thrust Chamber Proof Pressure and Leakage
  - c. Propellant Valve Electrical Resistance
  - d. Propellant Valve Dielectric Strength
  - e. Propellant Valve Functional
- 3. Mechanical Shock Test
  - a. Propellant Valve Proof Pressure and Leakage
  - b. Thrust Chamber Proof Pressure and Leakage
  - c. Propellant Valve Electrical Resistance
  - d. Propellant Valve Dielectric Strength
  - e. Propellant Valve Functional
- 4. Mission Duty Cycle to Failure Test
- 5. Disassembly and Inspection (Thrust Chamber Only)
- 6. Explosive Atmosphere Test (Propellant Valves Only)
  - a. Propellant Valve Proof Pressure and Leakage
  - b. Propellant Valve Electrical Resistance
  - c. Propellant Valve Dielectric Strength
  - d. Propellant Valve Functional



- 7. Fuel and Oxidizer Resistance Test (Propellant Valves Only)
  - a. Propellant Valve Electrical Resistance
  - b. Propellant Valve Functional
  - c. Propellant Valve Dielectric Strength
  - d. Propellant Valve Proof Pressure and Leakage
  - e. Propellant Valve Load Analysis
- 8. Disassembly and Inspection (Propellant Valves Only)

#### Unit 2

- 1. Visual Inspection
  - a. Component Modification
- 2. Temperature Shock Test
  - a. Propellant Valve Proof Pressure and Leakage
  - b. Thrust Chamber Proof Pressure and Leakage
  - c. Propellant Valve Electrical Resistance
  - d. Propellant Valve Dielectric Strength
  - e. Propellant Valve Functional
- 3. Impulse\_Signal Width Test
- 4. Mission Duty Cycle to Guaranteed Life Test (160 Seconds)
- 5. Disassembly and Inspection

### Unit 3

- 1. Visual Inspection
  - a. Component Modification



- 2. Mission Duty Cycle to In-Specification Life (118 Seconds) and Hot-Fire Burst Pressure Test
- 3. Disassembly and Inspection

#### TEST UNIT IDENTIFICATION P/N 208160-61

- 1. Unit 1, S/N 4058233
- 2. Unit 2, S/N 4058232
- 3. Unit 3, S/N 4057532

TEST DESCRIPTION AND RESULTS, UNIT 1

VISUAL INSPECTION

#### Description

Unit 1 was inspected to ensure that it was of the proper configuration, was undamaged, and had been subjected to and passed an acceptance test per Rocketdyne Specification RA0220-354.

Following the visual inspection, Unit 1 was modified by the addition of simulated spacecraft system tube extensions (P/N 99-106694 and P/N 99-106695) to the existing fuel and oxidizer inlet tube stubs. Installation of the tube extensions was accomplished per Rocketdyne Specification RA0607-009, "In Place Brazing of Tubes and Fittings for Space Engines."

#### Results

The visual inspection was successfully completed.



#### VIBRATION TEST

#### Description

Unit 1 was subjected to random vibration testing along each of the three mutually perpendicular axes. The random vibration time for each axis was 8 minutes less the equalization time required to verify spectrum shape and tolerance. The maximum-allowable equalization time was 20 percent of the vibration time for each axis.

Prior to the start of the random vibration testing in each axis, a sinewave survey (1-g maximum peak, logarithmic sweep from 5 to 2000 cps in 5 minutes) was conducted to calibrate the input and output accelerometers.

During the vibration test, the TCA was mounted in MAC-supplied spacecraft bracketry, which in turn was mounted in a rigid test fixture.

The random vibration test was at an overall equivalent level of 7.5 g rms. The vibration frequency was varied from 20 to 2000 cps. The vibration spectrum was as follows:

- 1. 0.02 to 0.12  $g^2/cps$  from 20 to 100 cps
- 2.  $0.2 \text{ g}^2/\text{cps}$  from 100 to 300 cps
- 3.  $0.12 \text{ to } 0.01 \text{ g}^2/\text{cps from } 300 \text{ to } 600 \text{ cps}$
- 4.  $0.01 \text{ g}^2/\text{cps}$  from 600 to 2000 cps

Propellant valve leakage and functional tests and thrust chamber proofpressure and leakage tests were conducted following the completion of the vibration testing.



#### Results

The vibration test was successfully completed.

#### MECHANICAL SHOCK TEST

In preparation for the mechanical shock test on Unit 1, the simulated spacecraft system tube extensions were replaced by inlet tube adapters (P/N 99-106126-11). Installation of the adapters was accomplished per Rocketdyne Specification RAO607-009, "In-Place Brazing of Tubes and Fittings for Space Engines."

#### Description

Unit 1 was installed in a standard Rocketdyne shipping container and was subjected to three shocks in each direction along each of the three mutually perpendicular axes for a total of 18 shocks. The shocks were of 15 g magnitude and 11-millisecond duration.

Following the mechanical shock testing, propellant valve leakage and functional tests and thrust chamber proof pressure and leakage tests were conducted.

#### Results

The mechanical shock test was successfully completed.



MISSION DUTY CYCLE TO FAILURE TEST

#### Description

Unit 1 was installed in the hot-fire test facility and was subjected to a Mission Duty Cycle Test (MAC MDC OCA-113) to failure. The first portion of the MDC was a "cape firing cycle" conducted at local ambient temperature and pressure, after which the TCA was allowed to return to local ambient temperature. The second portion of the MDC consisted of operating the TCA as described in Table II, page 428 (Appendix D) to failure. This MDC was conducted at a simulated altitude in excess of 100,000 feet and at local ambient temperature.

#### Results

The Mission Duty Cycle to failure test was successfully completed; however, the TCA shell temperatures exceeded the specification limit of 550 F by 50 F after 118 seconds of mission duty cycle burn time. The test was continued because it was believed that the MDC test results and the subsequent shell temperature failure analysis would not be comprised. This judgement was verified by the test results. The TCA completed the MDC with no performance degradation or incipient mechanical failure. The failure was reported in OFR (FAR) 12917R (Appendix B).



#### EXPLOSIVE ATMOSPHERE TEST

#### Description

The propellant valves were removed from Unit 1, installed in special test fixtures, placed in an explosive atmosphere test chamber, and exposed to an environmental temperature of 160 F. A potentially explosive atmosphere was created in the test chamber by the introduction of a butane gas-air, The valves were then actuated at several simulated pressure altitudes between sea level and 50,000 feet. For each required pressure altitude, the valves were actuated as follows: ten actuations at a pressure altitude 5000 feet above the required level, then one actuation at each of 10 equally spaced pressure altitudes down to 5000 feet below the required pressure altitude except at sea level (no tests were conducted at pressure altitudes below sea level). The valves were energized with 26 vdc for 10 seconds during each actuation to demonstrate the ability to actuate without igniting the explosive atmosphere. Prior to the first and after the final actuation, a sample of gas from the chamber was removed and spark ignited to demonstrate combustibility. Prior to and following the explosive atmosphere test, propellant valve leakage and functional tests were performed.

#### Results

The explosive atmosphere test was successfully completed.

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FUEL AND OXIDIZER RESISTANCE TEST

#### Description

The propellant valves were installed in special test fixtures, installed in the propellant resistance test facility, filled with the respective propellants [fuel (MMH) and oxidizer (NTO)] and temperature conditioned to 160 F. The valves were then to be exposed to propellant for a period of 2 weeks (336 hours). During this time, the valves were to have been actuated three times daily at equally spaced intervals with oscillograph recordings being made to verify proper valve operation. Leakage and functional tests were conducted on the valves following the propellant exposure period.

#### Results

After the fuel valve had been exposed to propellant for 1-1/2 days, a leak was noted in the test facility propellant system. This leak was found to be caused by the use of a noncompatible seal. Since this presented the possibility of contamination of the valve, the valve was removed, flushed, and functionally tested, the test facility was equipped with the proper seals, and the propellant exposure test was restarted with test exposure time reverting to zero as authorized by Rocketdyne Internal Letter 4388-5219 (page 292, Appendix D). The fuel resistance test was then successfully completed.

After the oxidizer valve had been exposed to propellant for 1-1/2 days, the valve failed to open during a scheduled actuation. This failure was reported to OFR (FAR) 12895R (Appendix B). During a subsequent functional



test conducted as part of the failure analysis, the valve operated normally. The test facility electrical wiring was then checked and was found to have a short circuit which prevented the electrical signal from reaching the propellant valve. Propellant valve functional tests were then performed to verify normal operation, the facility was repaired, and the propellant exposure test was restarted with test exposure time reverting to zero, as authorized by Rocketdyne Internal Letter 4388-5239 (page 295, Appendix D). The oxidizer resistance test was then successfully completed.

DISASSEMBLY AND INSPECTION

#### Description

Unit 1 was visually inspected for any defects, damage, or abnormal wear. The disassembly consisted of: (1) sectioning the propellant valves at the fabrication welds, (2) disassembly of the propellant valve internal parts, and (3) sectioning the thrust chamber body. The propellant valve parts and thrust chamber sections were visually inspected to determine the internal condition. A record was made of the pertinent items. Following the normal disassembly and inspection, the thrust chamber body was sectioned into quarter segments for further study as authorized by Rocketdyne Internal Letter 4388-5234 (page 258, Appendix D).

#### Results

The predisassembly inspection of Unit 1 revealed slight ablative material separation in the nozzle. The postdisassembly inspection revealed ablative material separation in the combustion zone and that the char front extended into the asbestos tape wrap.



TEST DESCRIPTION AND RESULTS, UNIT 2

VISUAL INSPECTION

#### Description

Unit 2 was inspected to ensure that it was of the proper configuration, was undamaged, and had been subjected to and passed an acceptance test per Rocketdyne Specification RA0220-354.

Following the visual inspection, Unit 2 was modified by the addition of propellant valve inlet tube adapters (P/N 99-106126-11) to the existing oxidizer and fuel inlet tube stubs. Installation of the adapters was accomplished per Rocketdyne Specification RAO607-009, "In-Place Brazing of Tubes and Fittings for Space Engine."

#### Results

Visual inspection was successfully completed.

TEMPERATURE SHOCK TEST

#### Description

Unit 2 was placed in a temperature-controlled chamber and exposed to a temperature of 185 F for a period of 4 hours. It was then transferred, within 5 minutes, to a second temperature-controlled chamber where it was exposed to a temperature of -40 F for 4 hours. This was repeated



until a total of three heating and three cooling cycles were accumulated. The TCA was then allowed to return to room temperature and within 1 hour thereafter was subjected to propellant valve leakage and functional tests and a thrust chamber proof pressure and leakage test.

#### Results

The temperature shock test was successfully completed.

IMPULSE\_SIGNAL WIDTH TEST

#### Description

Unit 2 was installed in the hot-fire test facility and was subjected to an impulse-signal width test series. The tests in this series were conducted at a simulated pressure altitude in excess of 100,000 feet and environmental temperatures as indicated below. The first portion of the series consisted of pulse-width survey tests consisting of 20 pulses each at electrical signal durations of 11, 15, 20, 30, 50, and 100 milliseconds. The pulse period in each case was a minimum of 3 seconds. A 2.5-second steady-state test for performance verification followed the pulses. The data were then reduced to determine the electrical signal width required for an impulse bit of 0.25 lb-sec total impulse.

The second portion of the series consisted of pulse repeatability tests. These tests were to be conducted with the propellants and the TCA injector conditioned to temperatures of local ambient, 160 F, and 20 F.



The pulse-repeatibility test conducted at each temperature consisted of 20 pulses each using propellant valve control voltages of 22, 26, and 30 vdc, and the pulse-signal width determined by the pulse-width survey tests. The pulse period in each case was a minimum of 3 seconds. In addition, along with each pulse repeatability test at each temperature, a 2.5-second steady-state firing was to be conducted to verify TCA performance and satisfactory instrumentation operation.

#### Results

The first attempt to conduct the pulse-width survey tests was terminated as a result of problems encountered with the test facility propellant feed systems. Following correction of the test facility problem, the pulse-width survey tests were repeated as authorized by Rocketdyne Internal Letter 4388-5299 (page 343, Appendix D).

The second attempt at the pulse-width survey tests was terminated as the result of a propellant valve electrical control system problem. The pulse-width survey tests were repeated again after correcting the electrical control system problem and were then successfully completed. The ambient temperature pulse repeatability test was also successfully completed.

The first attempt to conduct the hot mode pulse repeatability test was terminated as a result of problems encountered with the test facility environmental temperature conditioning system. Prior to the second attempt to conduct the hot mode repeatability test, a test facility verification test was conducted as authorized by Rocketdyne Internal Letter 4388-5309 (page 341, Appendix D). The oxidizer valve opened slowly on



the first pulse of this test. This failure was reported in OFR (FAR) 32656R (Appendix B). Subsequent timing checks conducted as a part of the failure analysis indicated that the valve was operating properly. The unit was then resubmitted to the hot mode pulse repeatability test as authorized by Rocketdyne Internal Letter 5388-626 (page 349, Appendix D). The hot mode pulse repeatability test was successfully completed.

The first two attempts to conduct the cold mode pulse repeatability test were terminated because of test facility environmental temperature conditioning system problems resulting in freezing of the oxidizder. Prior to the third attempt, the DAT specification was revised to change the cold mode temperature requirement from 15  $_{-0}^{+5}$  F to 20  $_{-0}^{+5}$  F. During the third attempt to conduct the cold mode pulse repeatability test the oxidizer valve operated sluggishly. This failure was reported in OFR (FAR) 12924R (Appendix B). This failure was also traced to problems with test facility temperature conditioning system. Prior to the fourth attempt to conduct the test, the temperature conditioning system was modified to improve the temperature control capabilities. The cold mode pulse repeatability test was then successfully completed.

MISSION DUTY CYCLE TO GUARANTEED LIFE TEST (160 SECONDS)

## Description

Unit 2 was installed in the hot-fire test facility and was subjected to a Mission Duty Cycle test to guaranteed life (MAC MDC OCA-113) (160 seconds). The first portion of the MDC consisted of a "cape firing cycle" conducted at local ambient pressure and temperature conditions after which the TCA was allowed to return to local ambient temperature. The second portion of the test consisted of operating the TCA as described in Table II, page 428 (Appendix D), up to 160 seconds of burn time.

R-15019-2



## Results

The mission duty cycle test to guaranteed life test was successfully completed.

DISASSEMBLY AND INSPECTION

## Description

Unit 2 was visually inspected for any defects, damage, or abnormal wear. The disassembly consisted of: (1) removal of the propellant valves, (2) sectioning the propellant valves at the fabrication welds, (3) disassembly of the propellant valve internal parts, and (4) sectioning the thrust chamber body. A record was made of the pertinent items.

### Results

The predisassembly inspection of Unit 2 revealed the following: (1) ablative material separation in the nozzle approximately 1 inch downstream of the throat insert, and (2) the first JTA graphite liner segment upstream of the throat was cracked two places.

The postdisassembly inspection revealed: (1) ablative material separation in the combustion zone, (2) three cracks in the throat insert, and (3) ablative material delaminations in the nozzle.



TEST DESCRIPTION AND RESULTS, UNIT 3

VISUAL INSPECTION TEST

## Description

Unit 3 was inspected to ensure that it was of the proper configuration, was undamaged, and had been subjected to and passed an acceptance test per Rocketdyne Specification RA0220-354.

The unit was then modified by the installation of propellant valve inlet adapters (P/N 99-106126-11) to the existing fuel and oxidizer inlet tube stubs. Installation of the adapters was accomplished per Rocketdyne Specification RA0607-009, "In-Place Brazing of Tubes and Fittings for Space Engines."

#### Results

The visual inspection was successfully completed.

MISSION DUTY CYCLE TO IN SPECIFICATION LIFE (118 SECONDS) AND HOT-FIRE BURST PRESSURE TEST

#### Description

Prior to the mission duty cycle test, Unit 3 was reworked by removing the propellant metering orifices. The Unit was then installed in the hot-fire test facility, and the propellant metering orifices were installed in the test facility propellant feed systems so that the propellant could be allowed to flow through the orifices during the MDC test and later bypass the orifices during the hot-fire burst pressure test.

R-15019-2



The first portion of the MDC was a "cape firing cycle" conducted at local ambient pressure and temperature, after which the TCA was allowed to return to local ambient temperature. The second portion of the MDC consisted of operating the TCA as described in Table II, (page 428 Appendix D) up to 117 seconds of burn time.

During the temperature "soakout" period following the MDC, the propellant tank pressures were raised to 750 psig and the orifice bypass valves were opened. After all TCA shell temperatures had peaked and dropped 5 F, a 3-second steady-state burst pressure test was conducted.

#### Results

The MDC to in specification life and hot-fire burst pressure test was successfully completed; however, the throat station shell temperature exceeded the allowable temperature of 550 F by 100 F after 118 seconds of burn time. The test was continued because it was believed that the test results and the subsequent shell temperature failure analysis would not be compromised. This judgement was verified by the test results. This failure was reported in OFR (FAR) 12954 (Appendix B).

A chamber pressure of 320 psia was obtained during the hot-fire burst pressure test.

DISASSEMBLY AND INSPECTION

## Description

Unit 3 was visually inspected for any defects, damage, or abnormal wear.

A record was made of pertinent items of condition visible prior to



disassembly. The disassembly consisted of: (1) removal of the propellant valves, (2) sectioning the propellant valves at the fabrication welds, (3) disassembly of the propellant valve internal parts, and (4) sectioning the throat chamber body. The propellant valve parts and chamber sections were visually inspected to determine internal condition. A record was made of the pertinent items.

### Results

The predisassembly inspection of Unit 3 revealed the following: (1) delaminations of the nozzle ablative material, (2) thermal discoloration of the stainless-steel shell, and (3) erosion of the threat and combustion zone liners.

The postdisassembly inspection revealed: (1) delaminations of the combustion zone ablative material, (2) a 360-degree circumferential crack in the throat insert, and (3) the ablative material in the combustion zone was charred out to the asbestos tape wrap.



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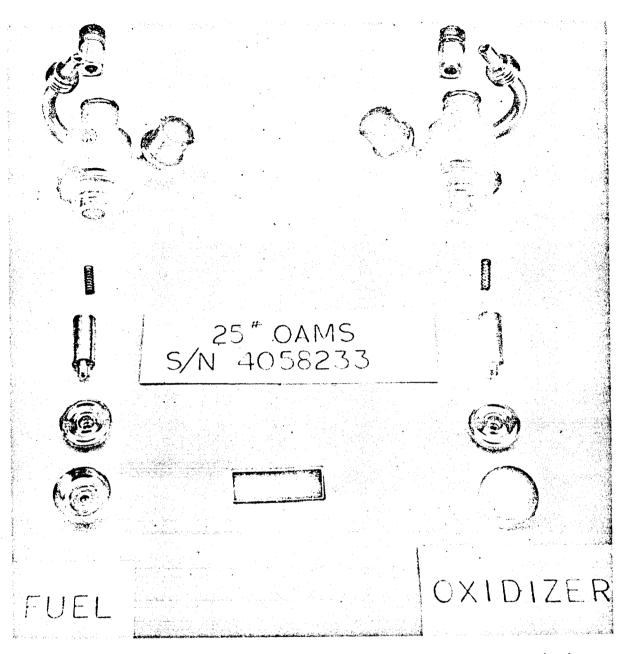
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# APPENDIX A

PHOTOGRAPHS OF TESTS AND TEST EQUIPMENT

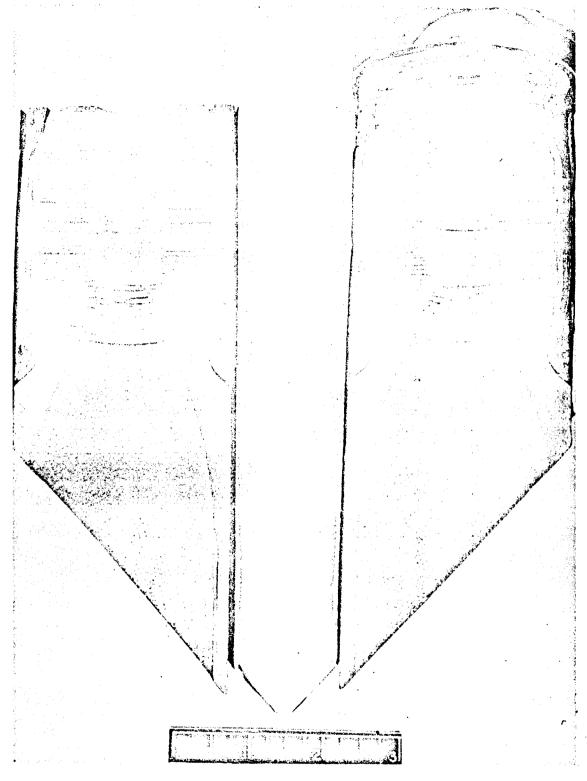




1HE65-7/23/65-C1

Figure 4. 25-Pound- Thrust OAMS TCA DAT Unit 1 Propellant Valves Disassembly and Inspection





1HE35-11/25/64-C1A

Figure 5. 25-Pound-Thrust OAMS TCA DAT Unit 1 Disassembly and Inspection Post-MDC to Failure Test (View 1) R-15019-2

35



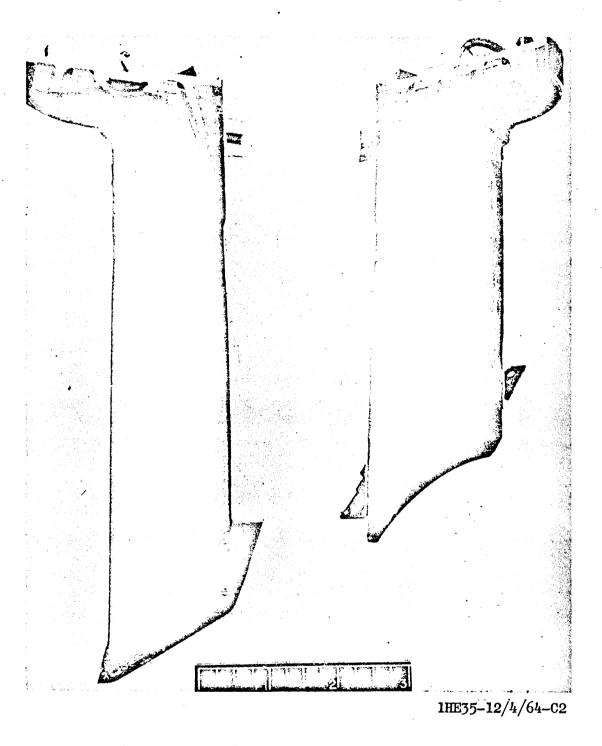
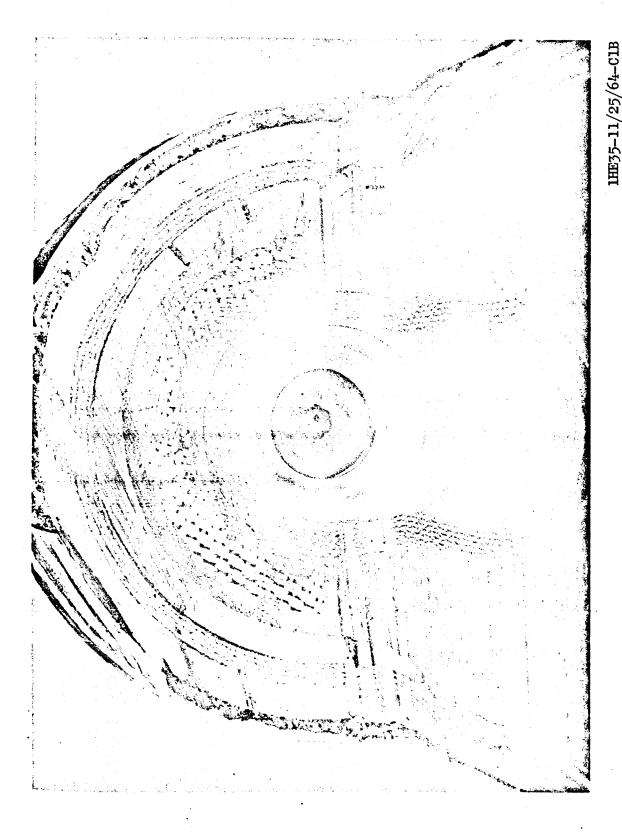


Figure 6 . 25-Pound-Thrust OAMS TCA DAT Unit Disassembly and Inspection Post-MDC to Failure Test (View 2)

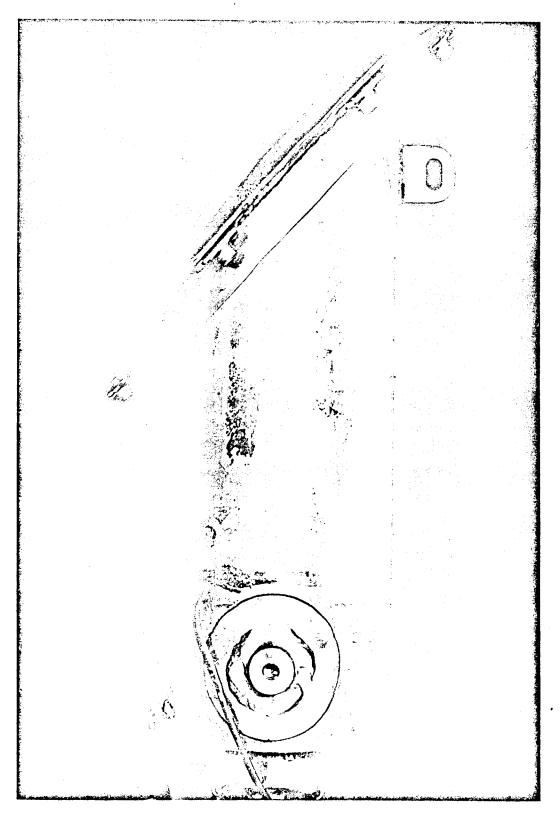




I Disassembly and Inspection 25-Pound-Thrust OAMS TCA DAT Unit Post-MDC to Failure Test (View 3)

R-15019-2

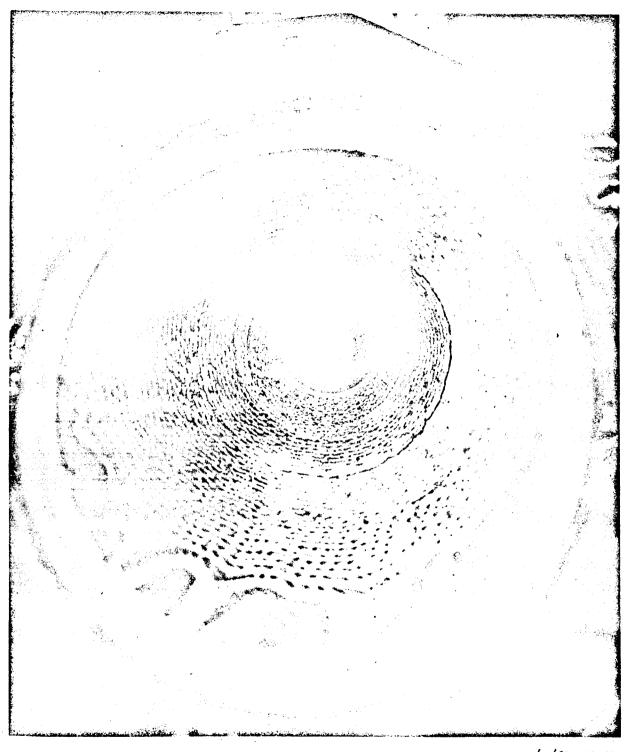




1HE25-10/7/64-S1A\*

Figure 8. 25-Pound-Thrust OAMS TCA DAT Unit 1 Post-MDC to Failure Test, View 1

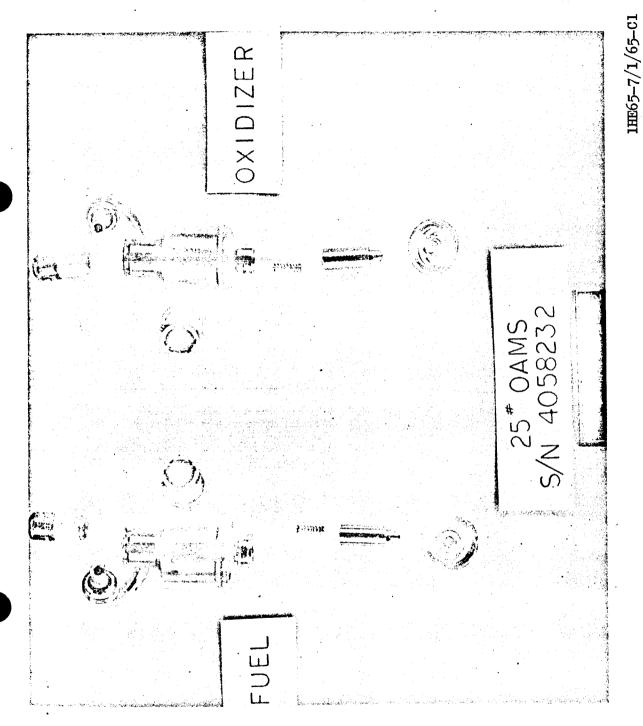




1HE25-10/7/64-S1C\*

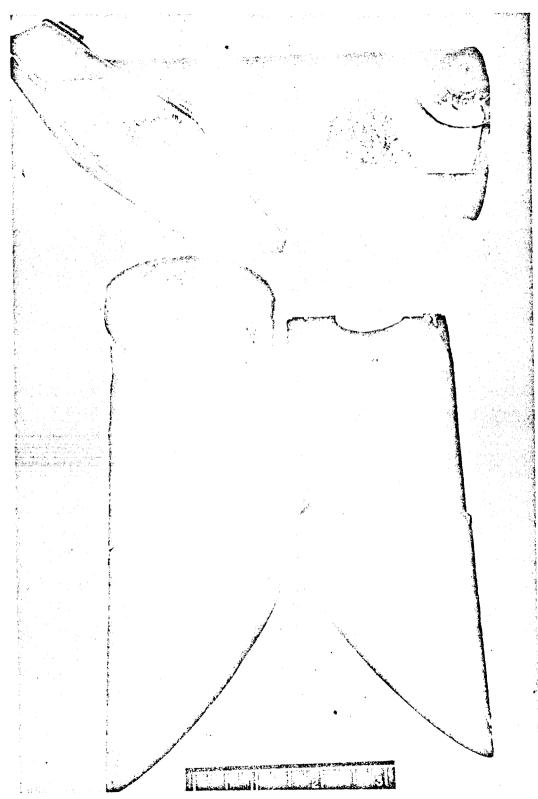
Figure 9. 25-Pound-Thrust OAMS TCA DAT Unit 1
Post-MDC to Feilure Test, View 2





25-Pound-Thrust OAMS TCA DAT Unit 2 Propellant Valves Disassembly and Inspection Figure 10.

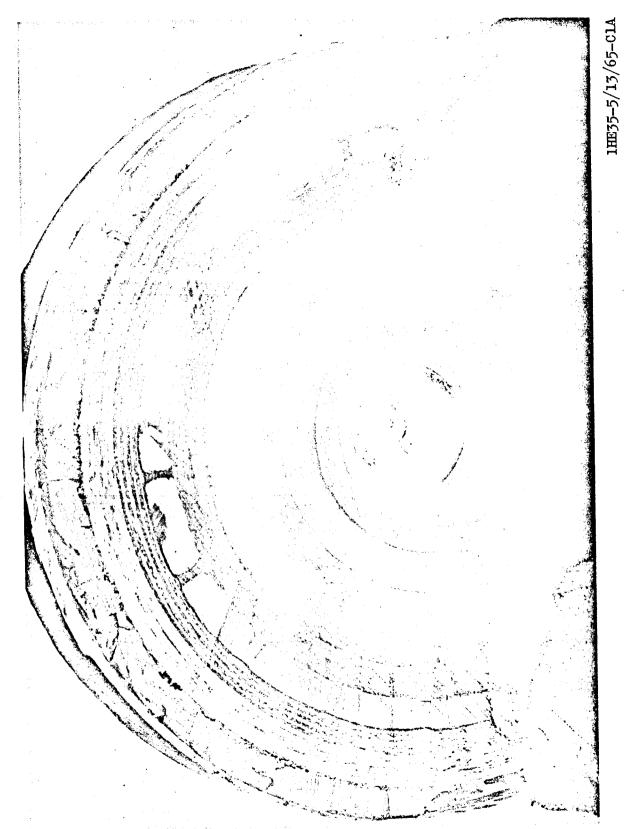




1HE35-5/13/65-C1B

Figure 11. 25-Pound-Thrust OAMS TCA DAT Unit 2 Disassembly and Inspection, Post-MDC to Guaranteed Life Test, View 1

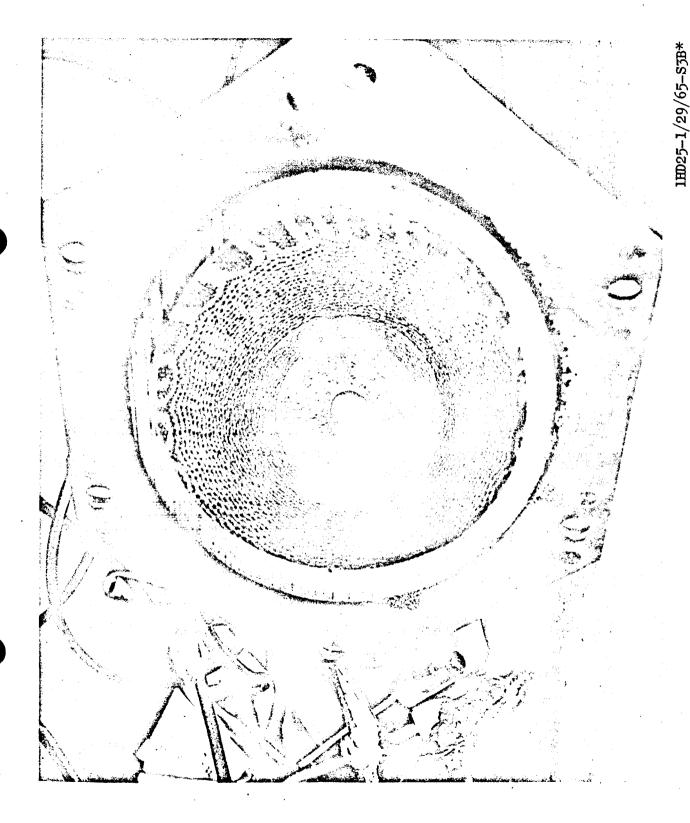




25-Pound-Thrust OAMS TCA DAT Unit 2 Disassembly and Inspection, Post-MDC to Guaranteed Life Test, View 2 Figure 12.

R-15019-2

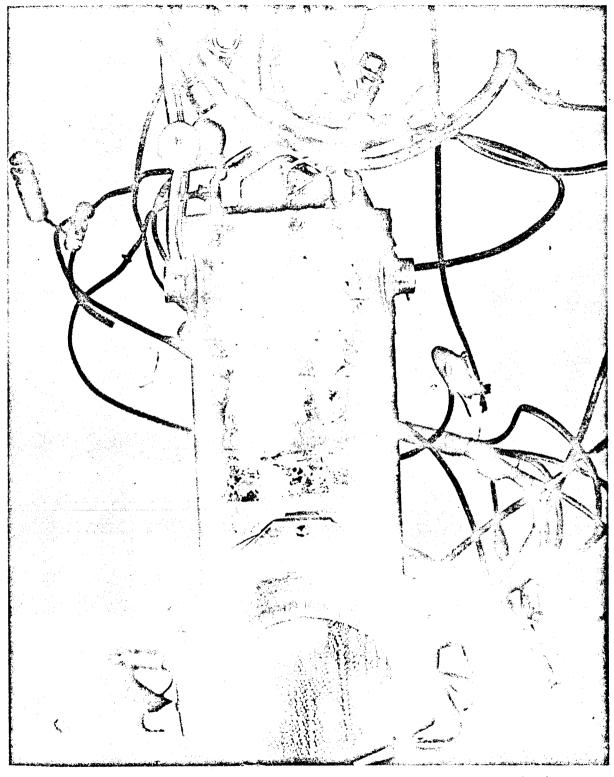




25-Pound-Thrust OAMS TCA DAT Unit 2 Post-MDC to Guaranteed Life Test, View 1

R-15019-2



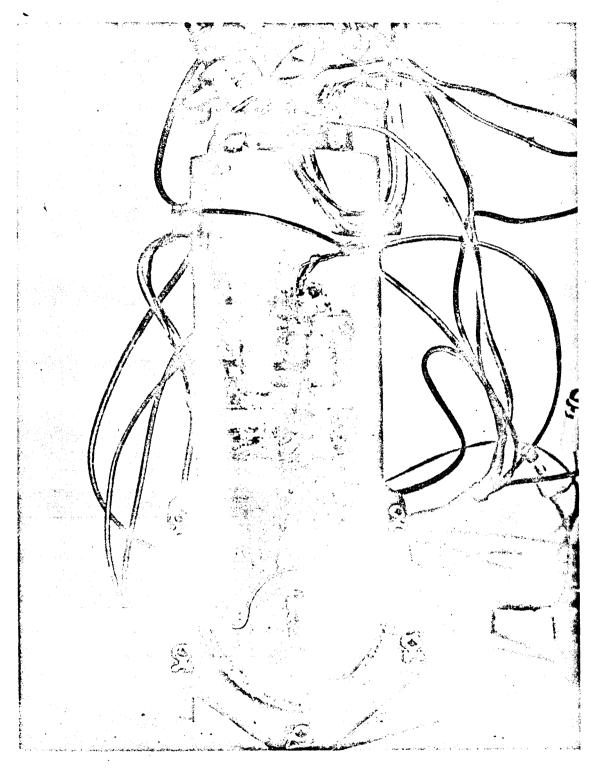


1HD25-1/29/65-S3C\*

Figure 14. 25-Pound-Thrust OAMS TCA DAT Unit 2 Post-MDC to Guaranteed Life Test, View 2

R-15019-2

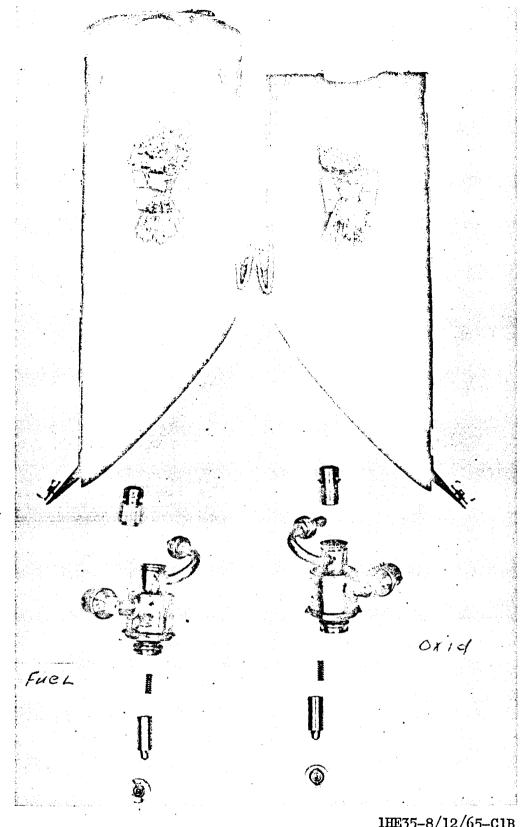




1HD25-1/29/65-S3A\*

Figure 15. 25-Pound-Thrust OAMS TCA DAT Unit 2 Post-MDC to Guaranteed Life Test, View 3

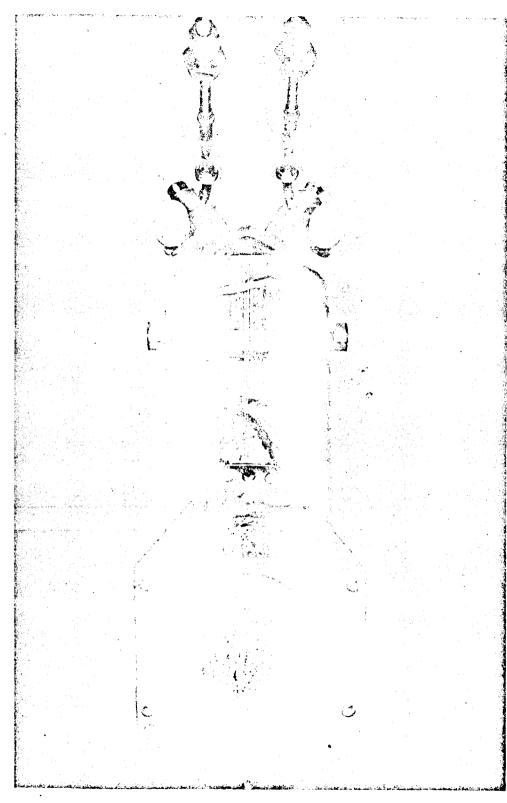




1HE35-8/12/65-C1B

Figure 16, 25-Pound-Thrust OAMS TCA DAT Unit 3 Disassembly and Inspection, Post-MDC to In-Specification Life and Hot-Fire Burst Pressure Test R-15019-2

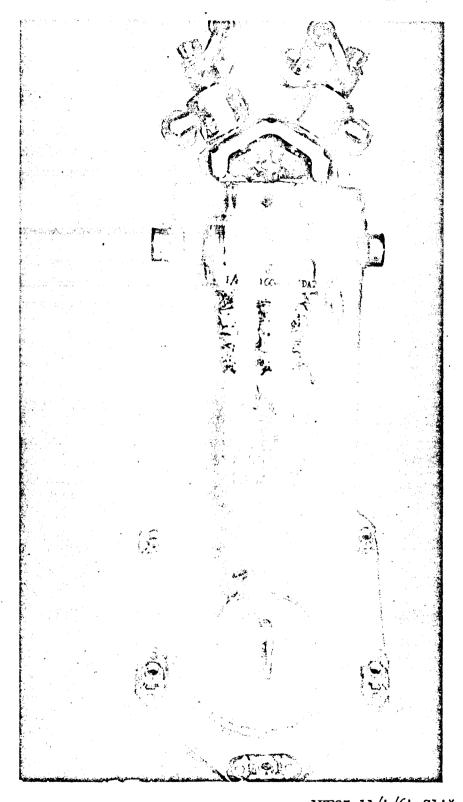




1HE25-11/4/64-S1B\*

R-15019-2 Figure 17. 25-Pound-Thrust OAMS TCA DAT Unit 3
Post-MDC to In-Specification Life and Hot-Fire Burst Pressure Test, View 1

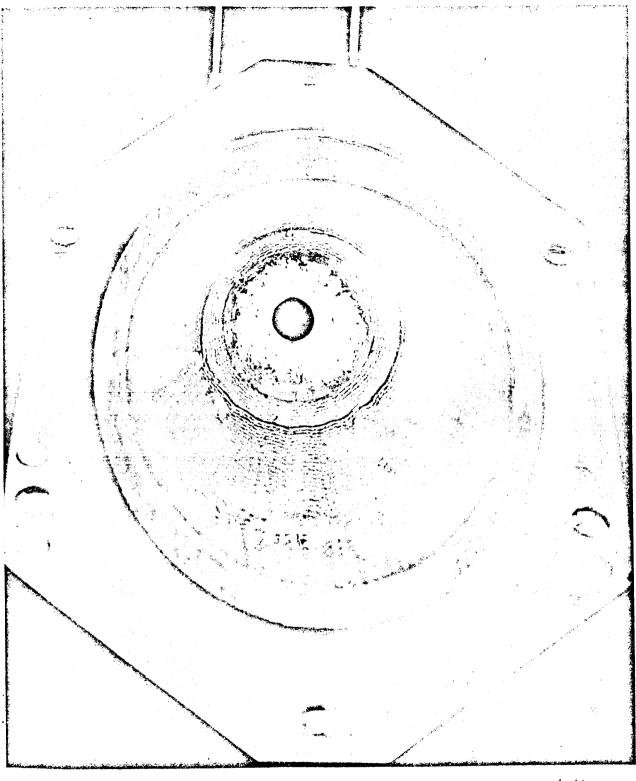




IHE25-11/4/64-S1A\*
Figure 18. 25-Pound-Thrust OAMS TCA DAT Unit 3 PostMDC to In-Specification Life and Hot-Fire

Burst Pressure Test, View 2





1HE25-11/4/64-S1C\*

Figure 19. 25-Pound-Thrust OAMS TCA DAT Unit 3 Post-MDC to In-Specification Life and Hot-Fire Burst Pressure Test, View 3 49

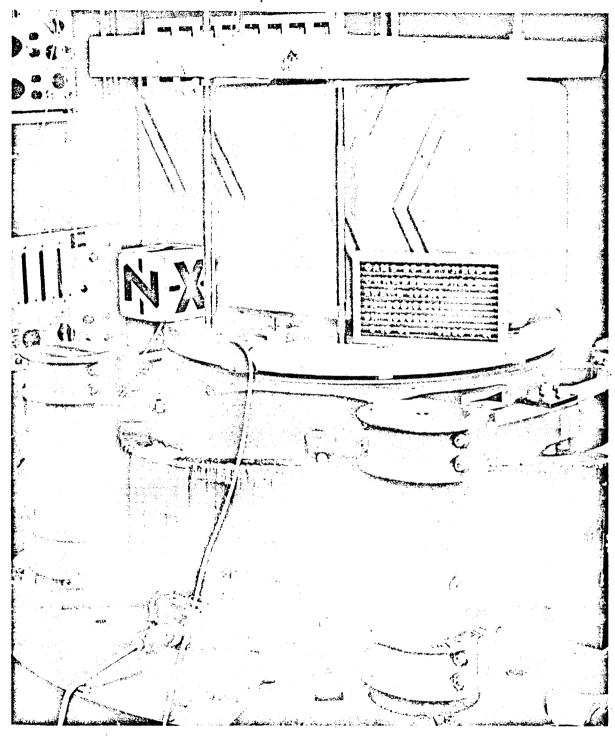




1HE34-9/3/64-C1

25-Pound-Thrust OAMS TCA DAT Unit 1 X-Axis Vibration Test Installation Figure 20.

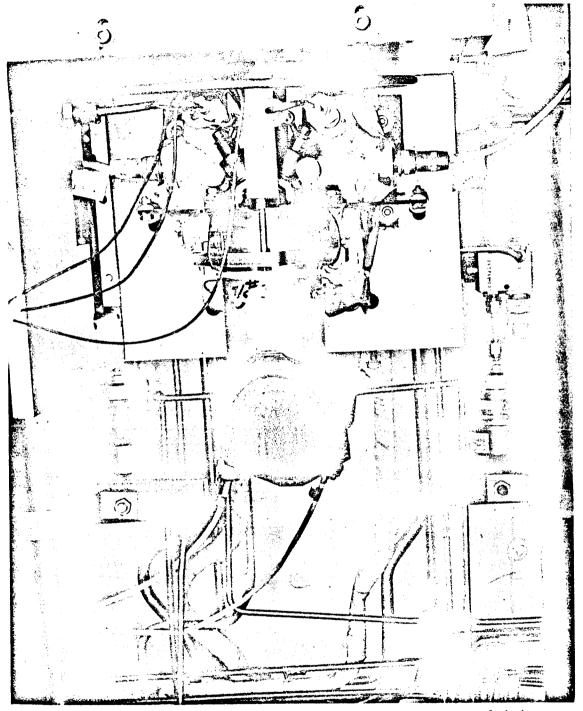




1HE34-9/10/64-C1

Figure 21. 25-Pound-Thrust OAMS TCA DAT Unit 1 Mechanical Shock Test Installation

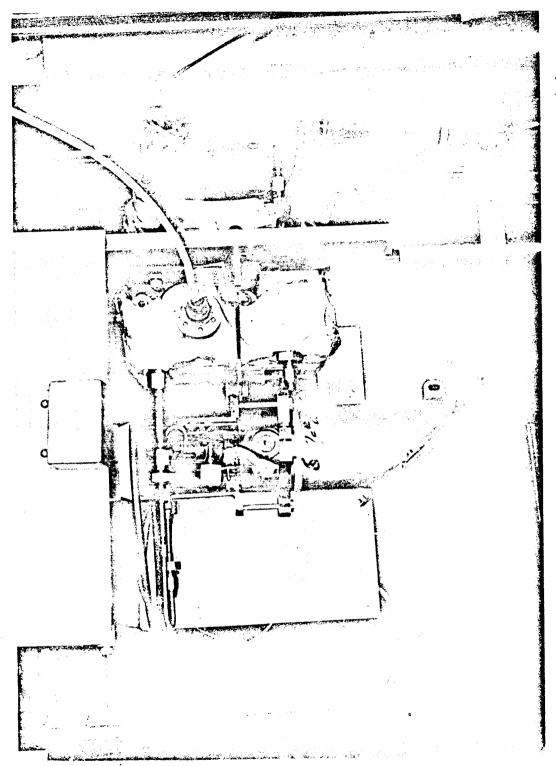




1HD33-10/1/64-S1A

Figure 22. 25-Pound-Thrust OAMS TCA DAT Unit 1 Hot-Fire Test Installation, CTL-3, Cell 39J, View 1

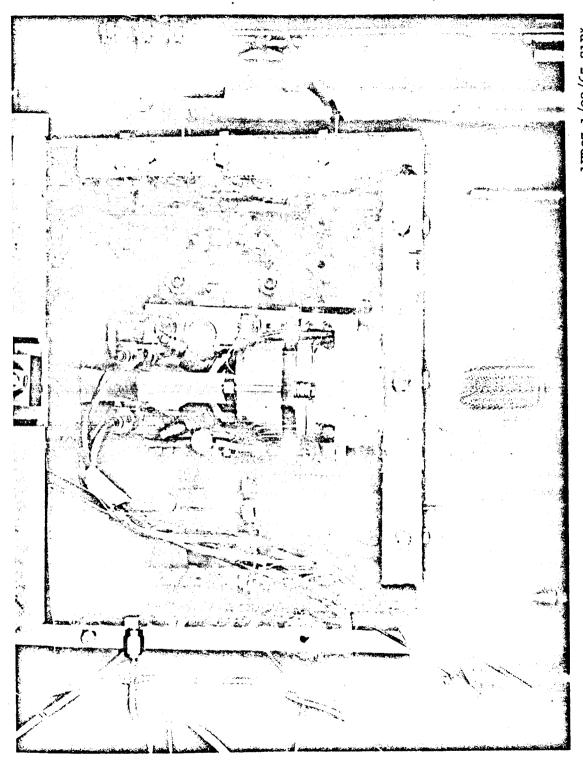




1ED 37-10/1/64-S1B

25-Pound-Thrust OAMS TCA DAT Unit 1 Hot-Fire Test Installation, CTL-3, Cell 39J. View 2



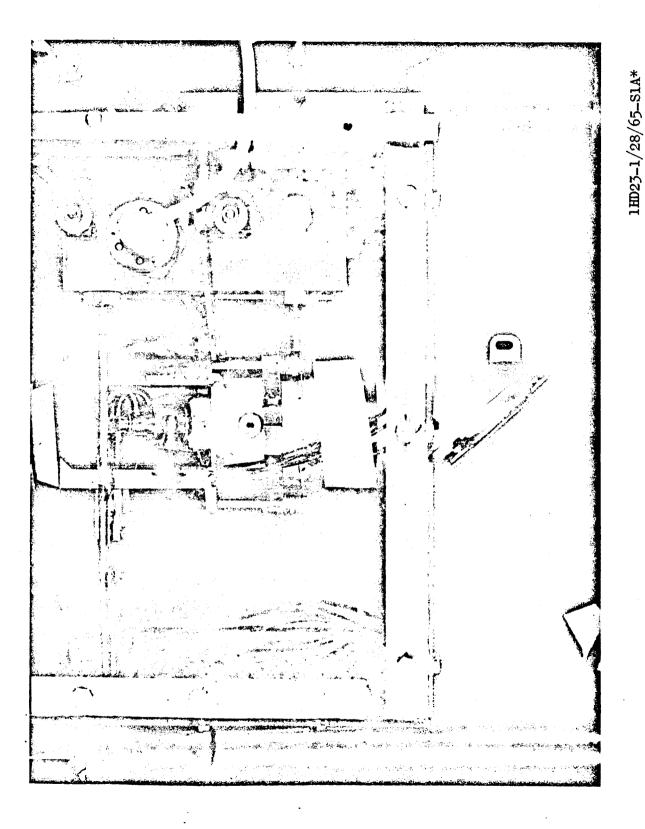


1m23-1/28/65-S1B\* 25-Pound-Thrust OAMS TCA DAT Unit 2 Impulse-Signal Width Test Installation, Cell 39J, View 1

R-15019-2

Figure 24.





25-Pound-Thrust OAMS TCA DAT Unit 2 Impulse-Signal Width Test Installation, Cell 59J, View 2 Figure 25.



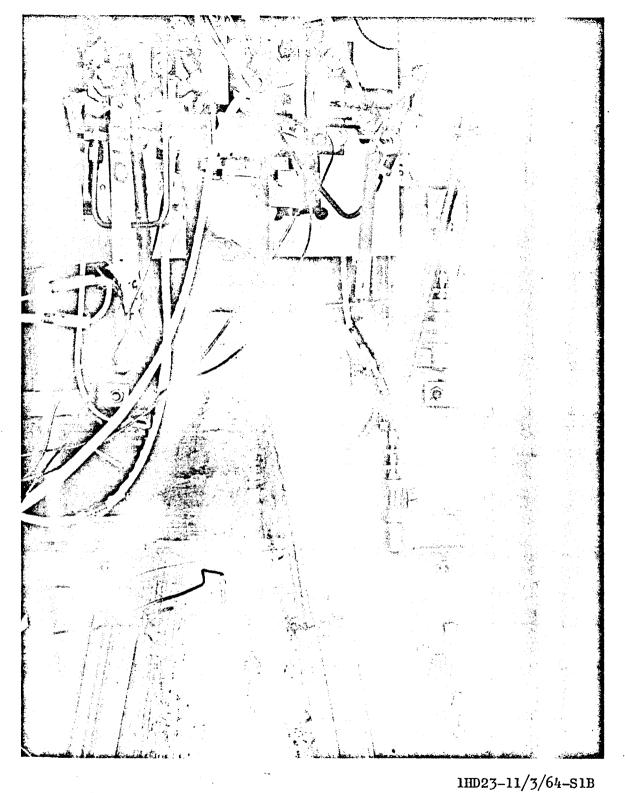
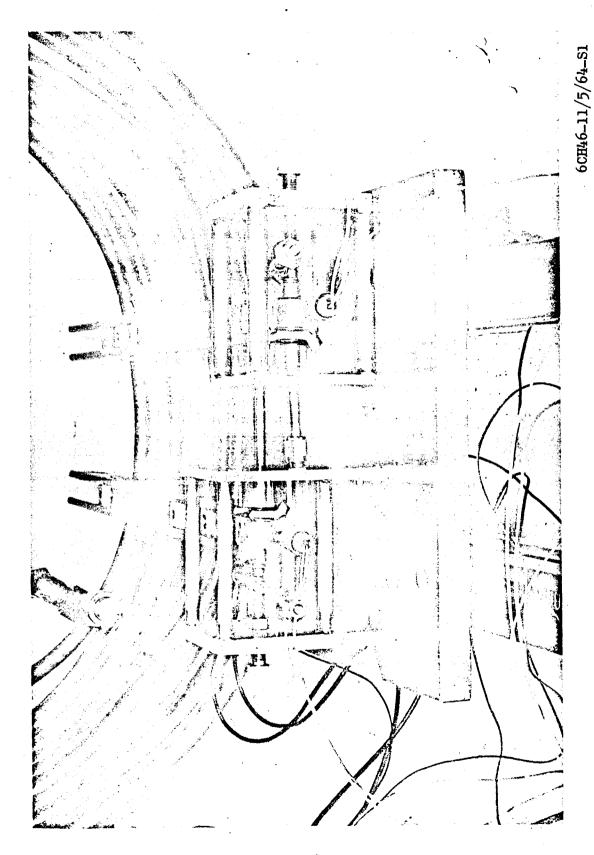


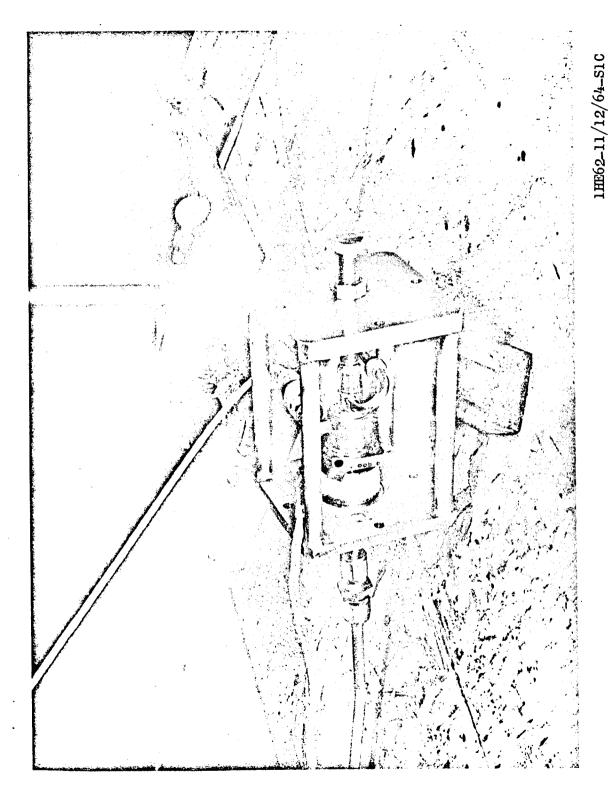
Figure 26. 25-Pound-Thrust OAMS TCA DAT Unit 3 Hot-Fire Test Installation Showing Hot-Gas Collection Cone, CTL-3, Cell 39J





25-Pound-Thrust OAMS TCA DAT Unit 1 Propellant Valves Explosive Atmosphere Test Installation Figure 27.





25-Pound-Thrust OAMS TCA DAT Unit 1 Fuel Propellant Valve Propellant Resistance Test Installation Figure 28.



#### APPENDIX B

OPERATION AND FAILURE REPORTS AND FAILURE ANALYSIS REPORTS



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#### XIAICUNE ... ... [] OPERATION Operation and Failure Report 12895R ROCKETDYNE FAILED DTIME DTO PART IDENTIFICATION PART DISPOSITION PART REPLACEMENT 1 PANT NO 7559 2 PART NAME Oxidizer Propellant Volice 1 D REPAIRED IN PLACE 1 D IDENTICAL ITEM OSI-OS T REPAIRED & RE-INSTALLED 9193579 ROCKETSYNE. 2 D SUBSTITUTE PART . NEXT ASSY NAME 7 NEXT ASSY PART NO. ☐ ELIMINATED 3 XNONE CONDEMNED 11 ENG AGE MODEL NO. O MISSILE SERIAL NO. 4 D NONE AVAILABLE HOLD FOR REPAIR 37 REPLACEMENT PART NO. S COMPONENT 7 DEPOTREPAIR 12 REJ. TAG NO. 6-HARDWARE S X FAILURE ANALYSIS SE REPLACEMENT SERIAL NO. D USED AS IS OFR ( FAILURE/OPERATION DATA VN#1 IT FAILURE DATE IS TEST OPER DATE IS TEST, OPER NO. 20 ITEMS 21 PROCEDURE-SPEC. & PARAGRAPH 208160-401 REPORTED BY FS 13 GROUP 44 SUPPLEMENT SHEET 1 D YES 2 D NO 23 5V R. Cole 29 MONTHS 30 INITIAL REPORT NO 31 47 STAND/AREA S ACTIVITY 2 OPERATION REPORTED OR IN PROGRESS ANALYSIS ASSIGNED A COMP/ASSY TEST H | MAINTENANCE 34 TIME PERIOD 335 AR (ACCEPT'RED' 8 TINAL ENG. ASSY. 1 D LEAK & FUNCTION DATE REPORT DATE REPORT DISTRIBUTED E C STORAGE L 🗀 STAT. MISS, TEST 2 XTEST F' 3 SHIPPING M E PROPEL LOADING 54 TEST OPER NO. 37 NTH CODE 38 TAPE CODE G TRECEIVING INSP. 3 D POST-TEST CAUSE! EFFECT? COMMENTS! FAR DUE RELIABILITY DESCRIPTION OF FAILURE WHERE' 35 D/836-394 11-26-64 INGPERATIVE DURING OXIDIZER 12395 SUSPECT SA PAILED DETAIL PART NO. 16 REF OFR 42 REF OFR RELIABILITY ANALYSIS USE ONLY LET TYPE TO GROUP ALEP

S DELETE

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HI PLACEMENT PART NO

SINSTALLATION PART TO

R-15019-2

# FAILURE ANALYSIS REPORT

#### ANALYST FILL OUT COVER SHEET ONLY

| OFR IDENTIFICATION | · · · · · · · · · · · · · · · · · · · |                          |        |            |
|--------------------|---------------------------------------|--------------------------|--------|------------|
| ofr no.<br>12895R  | OFR BY R. Cole                        | 896-388<br>NEPT. & GROUP | NA CA. | 11-14-64 · |

#### ART IDENTIFICATION

| MAI NO.           | SERIAL NO.         | PART NAME          | MFR. NAME . |
|-------------------|--------------------|--------------------|-------------|
| 407559            | 9193579            | Oxid. Valve        | Rocketdyne  |
| ENG/AGE MODEL NO. | ENG/AGE SERIAL NO. | TEST/OPERATION NO. |             |
| SE-7              |                    | l l                |             |

#### ANALYSIS BY

| NAME     | 21        | DEPT. 1 GROUP | ANALYSIS DATE | APPROVAL / / DSN DATE     |
|----------|-----------|---------------|---------------|---------------------------|
| R. Clark | con elses | 896-335       | 11-21-64      | (1) Smith 1/2/160 (18419) |
| •        |           |               |               | Et - 10 1/1/19 00 00      |

#### FAILURE ANALYSIS

F ANALYSIS AFFLIES TO MORE THAN ONE OFR, INSERT ALL AFFLICASLE OFR NUMBERS IN THIS SPACE

contamination in valve from the facility test set-up.\*

I. HISTORY 2. ANALYSIS 3. CONCLUSIONS 4. CORRECTIVE ACTION
• STATE ITEM NUMBER AND DESCRIBE • USE EXTRA SHEETS

MtCFM14 DECT RELIABILIT

SE SPECIFIC IN CORRECTIVE ACTION STATEMENT AND STATE EFFICTIVITY DATE AND/OR ENGINE SERIAL NUMBER WHERE APUICA 1. It was reported by the OFR that the subject valve failed to operate during a DAT oxidizer resistance test. The OFR stated: "Valve inoperative during oxidizer resistance test after one and a half days of testing. Suspect rubber

. USE DOTRA SHEETS IF NECESSARY

- The valve was sent to D/596-149 Laboratory for failure analysis which consisted of the following functional tests with no inlet pressure:
  - The pull-in current was checked and was found to be .15 AMPS.
  - The drop-out current was checked and was found to be .046 AMPS.
  - The energize time was checked and was found to be .0055 SEC with an applied current of .37 AMPS.
  - d. The de-energize time was checked and found to be .0014 SEC with the valve de-energized from .72 AMPS.

The above functional tests indicated that the valve was operating within specification. A trip was then made to the test site to examine the test set-up to determine if the failure could have been due to a test facility problem. The following information was obtained:

- The electrical cable which connected the valve to the power supply was found to be damaged. The insulation was burned off in several places which caused a direct short when power was applied.
- A fire had occurred in the chamber which burned the cable.
- The fire was caused by leaking NTO.
- The NTO leakage was caused by the use of a rubber "O" Ring in the test set-up filter connection, which was accidently installed. A teflon "O" Ring should have been used.

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FON4 LA NA XCV. 244

OFR No. 12895R 14 November 1964 Page 2

The valve was sent to the M & P lab for flushing. The effluent was analyzed to determine if corrosion processes had started inside the valve. The analysis indicated that corrosion had not started. The valve was returned to the DAT unit. It was recommended that the valve be given a complete functional test. If the valve passes the functional test, it will be re-started in the exidizer resistance test.

- 3. It is concluded that the reported failure was actually a test facility malfunction. The test valve did not actuate because of the faulty electrical cable.
- 4. No corrective action on the valve is required as the valve did not actually fail. The use of an improper "O" Ring which resulted in leakage and fire has been discontinued. All "C" Rings were checked to insure no further problems of this type.

FAILURE ANALYSIS
ACCEPTED F

CONTROL 12/22/09

CONTROL F 3/25/64

RELIABILITY DEPT. 261
MCDONNELL AIRCRAFT CORP.

M222

| Ų.  | Company to the second s | ives                         | Court Distract                                    | TTI                                       |
|-----|--|------------------------------|---|---|
| i)  | PART IDENTIFICATION  | NC                           | PART DISPOSITION                                  | PART REPLACEMENT                          |
|     | 1 PART NO 2 PART NAME 208/30-61 25 LB  | TCA-OAMS                     | 38  | 36  |
|     | 3 SERIAL NO. 4 MFG. NAME SMF   | R. 6 REF.                    | 1 D REPAIRED IN PLACE 2 D REPAIRED & RE-INSTALLED | 1 D IDENTICAL ITEM                        |
|     | 4058233 ROCKETOYNE 12  | 602                          | 3 ADJUSTED  | 2 C SUBSTITUTE PART                       |
|     |  | XT ASSY NAME                 | 4 D ELIMINATED                                    |   |
|     | 7707/3   | ONE                          | S CONDEMNED                                       | D HONE                                    |
|     | < = 7 CO   | DE                           | D HOLD FOR REPAIR                                 | 4 X NONE AVAILABLE                        |
|     |  | MPONENT                      | 7 D DEPOT REPAIR                                  | 37 REPLACEMENT PART NO.                   |
|     | 16 HA  | POWARE                       | 8 Y FAILURE ANALYBIS                              |   |
| 14  | co   | OE                           | • D USED AS IS                                    | 18 REPLACEMENT SERIAL NO.                 |
| 137 | FAILURE/OPERATION (  | DATA                         | 38 FAILED PART SENT TO CRIB                       |   |
| 9   | 4 10 15 1 19 3 957/0   | 90   ZO ITEMS                | 10 CAN CR113                                      | 41  |
| 57  | PROCEDURE-SPEC. & PARAGRAPH  |                              |   |   |
| CP  | 208160-401 7.1.4   |                              | REPOR   | TED BY                                    |
| _   | FB 25 FAIL TYPE 26 FAIL. CODE 27 SECO  |                              | AZ NAME /   |   |
| 3   | 23 SV 29 MONTHS 30 INITIAL REPORT NO 3   |                              | Tilm a. Denger                                    | 322 STEET Y NO                            |
| र । | 29 MONTHS 30 INITIAL REPORT NO 3   | 1                            | 43 /ACEBOVED BY                                   | 46 ACTIVITY 47 STAND AREA                 |
| 1,7 | NC 0 170172  |                              | Bull  | 9.57                                      |
| 20  | D2 OPERATION REPORTED OR IN PROGRESS  A □ COMP ASSY TEST H □ MAINTENANCE   |                              | ANALYSIS A  |   |
| 0   | B T FINAL ENG AREY A T LEAR & FUNCTION   | 4 TIME PERIOD<br>ACCEPT RED! | 48 NAME   | 49 GEOLP SOCOGE   SI PART REG.            |
| . 4 | G B ELEC-MECH, CHECK J F. SIM, LAUNCH  | TATIC TEST ONLY)             | 11. IMPSDEIJ                                      | 335 AR XVES 5 NO                          |
| 7   | O LI ACCEPI, RAD TEST R L'HISSILE ACCEPT.  | 1 D PRE-TEST                 | DATE REPORT   32 RECEIVED                         | DATE REPORT  **                           |
| 9   | E D STORAGE L X STAT. MISS. YEST   | 2 X 7557                     | RECEIVED  | DATE REPORT CONTRIBUTED NO DAY            |
| 7   | F U SHIPPING M I PROPEL LOADING  |                              | USE S4 TEST OPER NO                               | 53 1 PT NIM CODE 30 TAPE CODE             |
| - 1 | G D RECEIVING INSP. N D PERIODIC INSP.   | a. C POST-TEST               | ONLY  | /12                                       |
|     |  |                              |   |   |
|     | DESCRIPTION OF FAILURE   |                              | WHEN' CAUSE' WHERE' EFFECT! HOW MUCH! COMMENTS!   | FAR DUE RELIABILITY                       |
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| 1   | 16 INSTALLATION PART NO 30 CON   | IFIG CODE 37 NA              | AME 60 GR RESP. CHICL M                           | R-15019-2                                 |

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# page 1 of 3

· ANALYST FILL OUT COVER SHEET ONLY

| OPK IDENTIFICATION  | •     |                                   |         |                       |
|---------------------|-------|-----------------------------------|---------|-----------------------|
| 0/R NO. 129177. OFR | J. R. | Ganger 890-383<br>E DEST. & GROUP | CTL-III | FAILURE DATE 10-15-64 |

#### PART IDENTIFICATION

| PART NO.          | SCRIAL NO.         | PART NAME           | MFR. NAME |
|-------------------|--------------------|---------------------|-----------|
| 203160-61         | 4.058233           | Thrust Chamber Assy |           |
| ENG/AGE MODEL NO. | ENG/AGE SERIAL NO. | TEST/OPERATION NO   |           |
| SE-7              | None               | 957-090             | •         |

ANALYSIS BY

NAMENS
J. W. Sheingold

OLFI. & GROUP

ANALYSIS DATE

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10-20-61,

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#### FAILURE ANALYSIS

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1. HISTORY 2. ANALYSIS 3. CONCLUSIONS 4. CORRECTIVE ACTION

STATE ITEM NUMBER AND DESCRIBE . USE EXTRA SHEETS IF NECESSARY

SEE SPECIFIC IN CORRECTIVE ACTION STATEMENT AND STATE EFFECTIVITY DATE AND/OR ENGINE SERIAL NUMBER WHERE APPLICABLE

- 1. Gemini 25 lb CAMS DAT Unit No. 1 failed to meet the SCD temperature requirements at ll8 seconds of accumulated firing time during the CCA-113 mission duty cycle. The temperature recorded was 50°F greater than the allowable maximum of 550°F. The test was continued to 175 seconds of accumulated CCA-113 mission duty cycle firing time (15 sec. beyond SCD guaranteed life requirements) with no structural failure. The test was conducted in the Tri-Mod test facility.
- ?. Analysis of the temperature-time data showed the outer shell skin temperatures to be greater throughout the mission duty cycle than anticipated from previous R&D tests. The R&D data was obtained from tests conducted in the large altitude simulator.

Post-test x-ray analysis showed the condition of the TCA to be like R&D chambers similarly tested. Sectioning of the TCA showed it to be charred through. It was thought that the recirculation of exhaust gases in the smaller altitude can (Tri-Mod) could account for the difference in temperature. To determine the extent of artificial skin heating during mission duty cycle testing as a result of hot gas recirculation in the Tri-Mod facility, a controlled test series was conducted using a 25 lb OAMS slave chamber. The test series consisted of both limited steady state and pulse testing at a simulated altitude of 170,000 feet and local ambient temperature. Four (4) strips of 0.375 inch square, 0.10 inch thick plastic packing material were suspended from each corner of the thrust measuring system housing with 4.5 inches of fiberglass string. Motion pictures taken during testing showed the four strips to fluctuate considerably during pulse testing and to stand out at an angle of 45 degrees during steady state firing. A velocity calculation was made on the basis of the steady state results and the velocity required to displace the plastic strips 45 degrees at 170,000 feet was seen to be on the order of 700 mph.

3. Conclusions - The inability of the TCA to meet the SCD temperature requirements is attributed to artificial skin heating resulting from hot exhaust gas recirculation. The motion pictures clearly pointed out the existence of a considerable environmental gas velocity which would not exist in the spacecraft. The hot gas recirculation is seen to be a result of incomplete pick up of the TCA exhaust gases from the Tri-Mod test rusing. The TCA would have satisfactorily completed the mission duty cycle within the temperature requirements had the hot gas recirculation not occurred.

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(innersity V

1. In order to eliminate artificial TCA skin heating in the Tri-Mod facility, a cylindrical shield has been fabricated for all TCA configurations with next part tested effectivity. The shield, fabricated of .020 stainless steel sheet, will be attached to the TCA flange through a formica base plate such that the test environment will more closely simulate that which the TCA would see during Gemini spacecraft operation.—(See Figure 1) {

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|   | MCDONNELL A   | RCRAFT CO | ORP.      |

A. PLEASE PROVIDE TEMP. - TIME DATA CURVES FOR THIS TEST VS. THE TEMP. - TIME DATA CURVES EVALUATED FROM THE R&D TESTING IN AN AMENDMENT TO THIS FAR.

20 October 1964 J. F. Sheingold

Tri-Mod Altitude Test Chamber

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# FAILUT ) ANALYSIS REPORT

CFR IDENTIFICATION

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MANALYST FILL OUT COVER SMEET ONLY

OFA SY LOCATION FAILURE DATE Concer A96-398 26:50 CTL-III 3.0-3.5-64

PLAT COMMECATION

| . W.J. 60.        | SERIAL NO.         | SMAN TANS           | MFZ HAME   |
|-------------------|--------------------|---------------------|------------|
| 2032.60-61        | 14058233           | Christ Charber Asav | Pocketdyne |
| ENG/AGE EGGEL NO. | ENGINGE SERIAL NO. | TEST/ONE/ATION NO.  |            |
| 52-7              | Mone               | 957-090             |            |

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SIZURE ANALYSIS

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• STATE ITEM NUMBER AND DESCRIBE
• USE EXTENDING I. HISTORY . USE EXTRA SHEETS IF NECESSARY DE SPECIFIC IN CORRECTIVE ACTION STATEMENT AND STATE EFFECTIVITY DATE AND/OR ENGINE SERIAL NUMBER WHEE

Para. 1, 3, and 4 - No change.

Para. 2 - In answer to questions raised concerning this FAR, Para. 2'is amended to read as follows:

> "Analysis of the temperature-time data showed the outer shell skin temperatures to be greater than anticipated from previous R&D tests (see Figures 1 and 2). The RAD data was obtained from tests conducted in the large altitude simulator. Figure 2 also indicates a more rapid rate of temperature increase with time during the re-entry portion of the mission duty cycle (the most severe portion of the test)",

Post-test x-ray analysis showed the condition of the TCA to be like RAD chambers similarly tested. Sectioning of the TCA showed it to be charred through. It was thought that the recirculation of exhaust gases in the smaller altitude can (Tri-Mod) could account for the difference in temperature. To determine the extent of artificial skin heating during fasion duty cycle testing as a result of hot gas recirculation in the Tri-Mod facility, a controlled test series was conducted using a 25 1b OAMS slave chamber. The test series consisted of both limited steady state and pulse testing at a simulated altitude of 170,000 feet and local ambient temperature. Four (4) strips of 0.375 inch square, 0.10 inch thick plastic packing material were suspended from each corner of the thrust measuring system housing with 4.5 inches of fiberglass string. Motion pictures taken during testing showed the four strips to fluctuate considerably during pulse testing and to stand out at an angle of 45 degrees during steady state firing. A velocity calculation was made on the basis of the steady state results and the velocity required to displace the plastic strips 45 degrees at 170,000 feet was seen to be on the order of 700 mph.

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FORM WI 7-2 224, 2-12

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FIG- 1 69

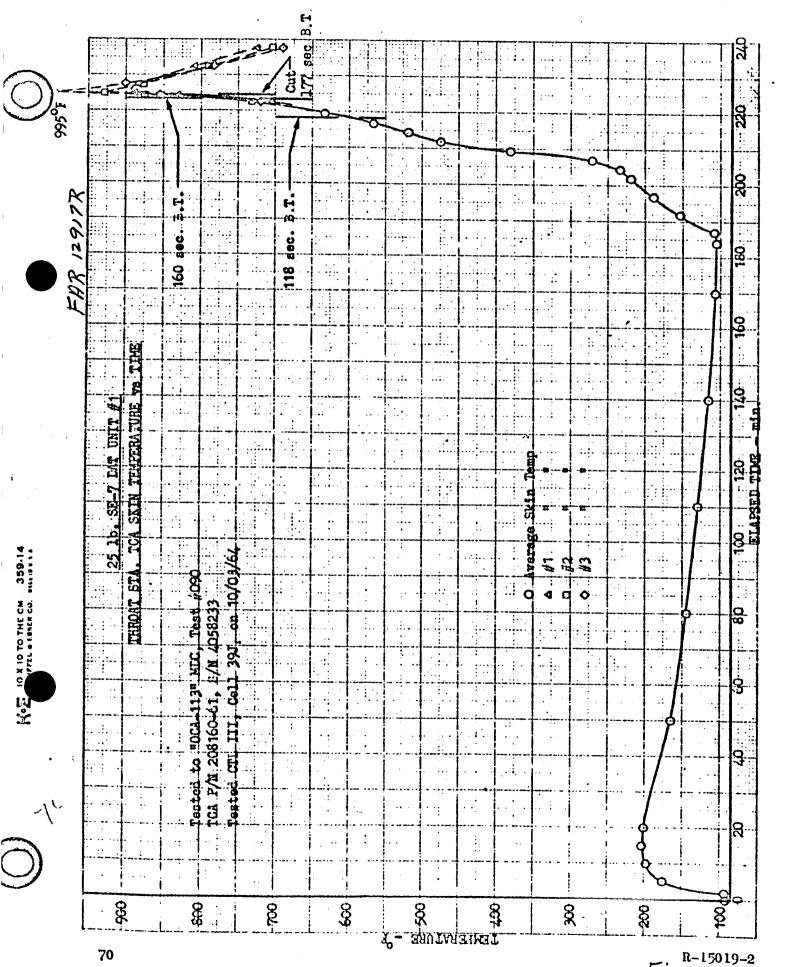


Fig = 15019-2

ofr 12917R

| FAILURE /                           | 52-5270        |
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| 1 PART NO  | 2 PART NAME                                  |                           |             | 38  | . 00111011                     |   | , KCPL                                | ACEME  |
| 203160<br>3 SERIAL NO.   | 4 MEG NAME   5 h                             |                           | ER          | 1 - REPAIRED IN                                   | PLACE                          | 36  |                                       |  |
| 4058237  | 1 - 1 - 1 - 1                                | MFR. BESIG                | ۵.          | 2 D REPAIRED A                                    | E-INSTALLED                    | 1   | ENTICAL ITE                           |  |
| 7 NEXT ASSY PART NO.   | & NEXT ASSY BERIAL                           | INEXT ASSY NAME           |             | 4 CELIMINATED                                     | •                              | 3 D NO  | BOTITUTE P                            | ART  |
| 10 MISSILE SERIAL NO.  | 11 ENG/AGE MODEL NO. 14 6                    | YSTEM                     |             | B CONDEMNED                                       |                                | i   |                                       |  |
| 12 REJ. TAG NO.  | SE-1 18 0                                    | CODE<br>COMPONENT<br>CODE |             | 6 D HOLD FOR RE                                   |                                |   | NE AVAILA                             |  |
| NE NE. ING NO.   | 16 H   | HARDWARE                  |             | 7 DEPOT REPAIL                                    | •                              |   | · · · · · · · · · · · · · · · · · · · |  |
| y A 1 1 1 1 1 1  |  |                           |             | 9 USED AS IS                                      |                                | 38 REPLA  | ACEMENT BE                            | ERIAL NO.  |
|  | RE/OPERATION                                 |                           |             | 39 FAILED PART BE                                 | NT TO:                         |   | •                                     |  |
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| 24 NC  |  |                           |             | 48 APPROVED BY                                    | 1.                             | 46 ACTIV  | /ITY                                  | 47 STAND/AF  |
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| d B Accelving Insp.  | N   PERIODIC INSP.                           | 3 POST-YES                | IT .        | USE   | ,                              | 133/3   | PYNTHE                                | DE SE TAPE   |
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# INO CICIEMD VIVIE A DIVISION OF NORTH AMERICAN AVIATION. INC.

· ANALYST FILL OUT COVER SHEET ONLY

OFR IDENTIFICATION

OFR NO.

12921/R

OFR BY

R. Cole

DEPT. & GROUP

CTL-III

1-16-65

PART IDENTIFICATION

| TAKI IDENTIFICATION |                    |                     | 145B 114145   |
|---------------------|--------------------|---------------------|---------------|
| PART NO.            | SERIAL NO.         | PART NAME           | MFR. NAME     |
| 1,07559             | 1,051,1,60         | Oxid. Solenoid Valv | e Rocketdyne  |
| ENG/AGE MODEL NO.   | ENG/AGE SERIAL NO. | TEST/OPERATION NO.  | _             |
| SE-7 DAT 208160-61  | 1:058232           | 207510-և01          | para. 7.2.3.1 |

ANALYSIS BY

|   | WINDERSON DI |            |                    |               |                | DSN DATE |
|---|--------------|------------|--------------------|---------------|----------------|----------|
| i | Citable      |            | HILL DEPT. & GROUP | ANALYSIS DATE | APPROVAL Z Z-3 | DSH DATE |
| ľ | NAME         |            | [///               | 0 /-          | estilator      | 1        |
|   | 1 2          | McClintock | 896-394            | 11-28-65      | Con pecton     |          |
|   | 1.           | 1100       | 0/0-//4            |               |                |          |

FAILURE ANALYSIS

IF ANALYSIS APPLIES TO MORE THAN ONE OFR, INSERT ALL APPLICABLE OFR NUMBERS IN THIS SPACE

1. HISTORY 2. ANALYSIS 3. CONCLUSIONS 4. CORRECTIVE ACTION

STATE ITEM NUMBER AND DESCRIBE . USE EXTRA SHEETS IF NECESSARY

BE SPECIFIC IN CORRECTIVE ACTION STATEMENT AND STATE EFFECTIVITY DATE AND/OR ENGINE SERIAL NUMBER WHERE APPLICABLE.

#### 1. History

The NTO TCA valve was reportedly stuck closed during a 15°F pulsing test. The low temperature environmental conditions were changed 3 times in order to improve the environmental atmosphere. The first system was composed of a salt brine solution leak line which was wrapped in aluminum foil and drained into a burlap wrapped propellant line to the top of the injector. Thermocouples were attached externally to the NTO valve inlet. and to the top center of the injector. Cooling in this method created dry spots which were noted to have considerably lower temperatures than the wet solution areas. To remedy the dry spot problem, the area between the injector and the valve was potted with paraffin for the alcoholwater system but was found to be of little value so the paraffin was re-The second system was an alcohol-water solution using the same test setup. A thermocouple was added to the NTO valve seat. Both the first and second systems were considered inadequate in that it was extremely difficult to control the temperatures. A third system was tried in which an environmental chamber was placed around the inlet lines and down over the TCA to the throat area. A purge line was plumbed into the chamber and vented a mixture of GN2 and LN2 vapor at low pressure. This system exhibited very steady temperature conditions, but the DAT TCA was not tested under this latter system.

#### 2. Analysis

The tests (runs #20 through #31) were reviewed to study the problem area. It was observed that usually the first 2 or 3 pulses were normal and then the NTO flow would taper off in successive pulses to no flow.

An R & D TCA was used in runs #23 through #31 which exhibited the same results as the DAT TCA tests. These verification tests indicated that a problem existed within the facility rather than the TCA NTO valve.

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An investigation of the facility revealed a strong probability that the NTO propellant was freezing. These areas were: (1) loss of NTO flow on the oscillographs, (2) difficulty in controlling the environmental temperature, and (3) the standardization for temperature calibration was found off 4 degrees. (NTO freezes at 11.84cF).

The TCA was placed in an environmental chamber and temperature was lowered and stabilized at 18°F. The NTO propellant valve was pressurized to 360 psig GN<sub>2</sub>. The valve was actuated 3 times each with 26, 30 and 22 volts with no indication of malfunctioning. An additional 10 cycles were completed with the same results. The NTO valve was checked for leakage and found satisfactory (<0.1 scc Helium/min).

#### 3. Conclusions

The NTO propellant froze as a result of poorly controlled environmental temperature and thus NTO flow ceased.

## 4. Corrective Action

Re-calibrate the temperature recording system and use the third system outlined in the 1. History to test the DAT TCA.

Above corrective action was implemented and the "low temperature impulse signal width test" was successfully completed on 29-30 January 1965.

| FAILURE ANAI          |         |
|-----------------------|---------|
| W. Jasken             | 2/17/65 |
| Charle                | 2/17/65 |
|                       |         |
| RELIABILITY DEPT. 261 |         |

| ٠,٥       | Operation and Failure Report   | XFAI       | BART CHANCE                      | ムハ                             | TANAMION NO           | 12954R                         |       |
|-----------|--|------------|----------------------------------|--------------------------------|-----------------------|--------------------------------|-------|
| I V       | ROCKETDYNE.  | X 14.1     | M EXPLOSED                       | TO E                           | -7 ///_ "             | 120011                         |       |
| - /       | PART IDENTIFICATION  |            | PART DIS                         | POSITION                       | PART REPLAC           | EMENT                          |       |
| 1         | 202160-61 254B 75-A-CA   | 1/15       | 38                               |                                | 30                    |                                |       |
| - ;       | 3 SERIAL NO. 4 MFG. NAME S MFR. CODE DESIGN OF THE SERIES  |            | 2 D REPAIRED & RE                |                                | I D IDENTICAL ITEM    |                                |       |
|           | 7 NEXT ASSY PART NO. 8 NEXT ABBY SERIAL 8 NEXT ASSY NAME NGILE NONE NONE   | _          | 3 ADJUSTED                       | •                              | 3 C NONE              | 1                              |       |
|           | IO MISSILE SERIAL NO. 11 ENG'AGE MODEL NO. 14 SYSTEM   |            | S CONDEMNES                      | PAI <b>R</b>                   | 4 X NONE AVAILABLE    |                                |       |
| 1         | 12 REJ. TAG NO. 13 ENG/AGE SERIAL NO. 16 HARDWARE  |            | 7 DEPOT REPAIR                   | •                              | 37 REPLACEMENT PART   | NO.                            |       |
|           | CODE   |            | PAILURE ANAL                     | LYSIS                          | 38 REPLACEMENT SERIAL | L NO.                          |       |
|           | FAILURE/OPERATION DATA   |            | 39 FAILED PART SE                | NT TO:                         |                       |                                |       |
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|           | 2021:0-401 7.3.2   |            |                                  | REPOR                          | TED BY                |                                | •     |
|           | 23 /19 /79   |            | 42 NAME A G.F.                   | KER                            | ع ا مرس               | UPPLEMENT<br>HEET<br>YES 2 KNO |       |
| general   | NC 7 NONE  |            | 43 400/2/25 57                   |                                | 46 ACTIVITY 47 S      | TANDIAREA<br>57                |       |
| <b>3</b>  | 12 OPERATION REPORTED OR IN PROGRESS   |            |                                  |                                | SSIGNED TO            |                                |       |
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|           | C D ELEC. MECH. CHECK J D SIM. LAUNCH D D ACCEPT. RED TEST K D MISSILE ACCEPT.   | l          | DATE REPORT                      | 52                             | DATE REPORT  53       |                                |       |
|           | E C STORAGE L X STAT. MISS. TEST F C SHIPPING M C PROPEL LOADING   |            | 134 7557                         | OPER NO.                       | ISS 1 / BZ NTH CODE!  | MO DAY                         |       |
|           | G - RECEIVING INSP. N - PERIODIC INSP. 3 - POST-TEST   |            | CNLY                             |                                | 562                   |                                |       |
|           | DESCRIPTION OF FAILURE   |            | WHEN'<br>WHERE'<br>HOW MUCH!     | CAUSE?<br>EFFECT?<br>COMMENTS? | Will out a f          | RELIABILITY                    |       |
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|           | U EXTENDING FROM THE   | <u> </u>   | CLLIY                            | _ <u></u>                      | 79                    | 7.0                            |       |
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|           | RELIABILITY ANALYSI  |            |                                  | JO PROP SYSTEM                 | 1 15                  |                                | X     |
|           | SNIN COMP 40 ASSY MS-E CD 48   | .11.       | L., J.,                          | OB DELETE                      | 70                    | 70                             | 129   |
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| en.       | INSTALLATION PART NO. 100 CONT - LUDE IN-15019-2   | 37 'ñ      | AHE OF GR ALEP                   | CHICL W                        | 75                    | 7.0 00                         |       |
|           | The Committee Co | i          | gray - Nazayetingerit - 2001 org |                                | 1. 1                  |                                |       |

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# DIVISION OF HORTH AMERICAN AVIATION INQ.

# FAILURE ANALYSIS REPORT

Amendment #1 OFR IDENTIFICATION

· ANALYST FILL OUT COYER SHEET ONLY

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|-----------|------------|--------|-----------|--------------------------|----------|---------|--------------------------|--|
| ofa no.   | 2954R      | OFR BY | J. Ganger | 896-388<br>DEPT. & GROUP | LOCATION | CTL-III | FAILURE DATE<br>11-13-64 |  |
|           |            |        |           |                          |          |         |                          |  |

#### PART IDENTIFICATION

| PART NO.          | SERIAL NO.         | PART NAME           | MFR. NAME  |
|-------------------|--------------------|---------------------|------------|
| 208160-61         | 4057532            | Thrust Chamber Assy | Rocketdyne |
| ENG/AGE MODEL NO. | ENG/AGE SERIAL NO. | TEST/OPERATION NO.  |            |
| SE-7              |                    | 957-126             | ·          |

ANALYSIS BY

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| - 1 | A A A A A #         |                        |                      |                   | ~~         |   |            |
|-----|---------------------|------------------------|----------------------|-------------------|------------|---|------------|
| - 1 | NAME                | Q DEPT. & GROUP        | ANALYSIS DATE APPROV | $\Delta L A \sim$ | <b>س</b>   | , _ , _ , _ , _ , _ , _ , _ , _ , _ , _ | DSN DATE   |
|     |                     | V)                     |                      | ~//.              | A No       | # A 2 V                                 | 1 200 0000 |
| - 1 | J. N. Sheingold     | **   896 <b>-</b> -335 | ANALYSIS DATE APPROV | 111               | $\sqrt{2}$ | <i></i>                                 | 1          |
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EAILURE ANALYSIS

ANALYSIS APPLIES TO MORE THAN ONE OFR, INSERT ALL APPLICABLE OF NUMBERS IN THIS SPACE

2. ANALYSIS 2. CONCLUSIONS 4. CORRECTIVE ACTION
• STATE ITEM NUMBER AND DESCRIBE • USE EXTRA SHEETS . USE EXTRA SHEETS IF NECESSARY . DE SPECIFIC IN CORRECTIVE ACTION STATEMENT AND STATE EFFECTIVITY DATE AND/OR ENGINE SERIAL NUMBER WHERE APPLICABLE

- 1. Gemini 25 lb OAMS DAT Unit No. 3 failed to meet the SCD temperature requirements after 118 seconds of accumulated OCA-113 mission duty cycle firing time. The temperature recorded was 100°F greater than the allowable maximum of 550°F. The mission duty cycle test was followed by a burst pressure test with no structural failure of the TCA. Testing was conducted in the Tri-Mod test facility utilizing a heat shield as shown in Figure 1.
- 2. Analysis of the temperature-time data showed the outer shell skin temperature to be greater throughout the mission duty cycle than anticipated from previous R&D and DAT component testing. The temperature recorded was also in excess of that obtained in OAMS DAT Unit No. 1 in the Tri-Mod facility with no heat shield (Figure 2). testing

The failure of DAT Unit No. 1 reported under OFR 12917R was seen in analysis to be a direct result of artificial TCA skin heating caused by recirculating hot TCA exhaust gases. The corrective action recommended was to install a heat shield which would enclose the thrust chamber. It was decided, however, to install a more permanent shield which would lend itself readily to all TCA configurations. No R&D tests were conducted prior to the subject DAT test for purposes of heat shield checkout, however, two strips of plastic packing material were suspended from the thrust measuring system in a similar fashion to that described in OFR 12917R except that the strips were larger for this test,

malysis of the motion pictures taken during the test showed these plastic strips to fluctuate during TCA pulsing. A comparison of these fluctuations with those referenced in OFR 12917R indicated that the displacements in both cases were of very nearly the same magnitude. However, since the mass of the strips was greater for the DAT Unit No. 3 test, it would require an equal or greater gas velocity to displace the strips by the amount noted. Also, the TCA exit was approximately 1.5 inches above the heat shield cone entrance possibly precipitating some exhaust "spill-over" caused by gas expansion at the TCA nozzle exit.

The inability of the TCA to meet the SCD temperature requirements is attributed to artificial skin heating resulting from the inability of the facility heat shield to prevent the hot TCA exhaust gases from recirculating. The motion pictures clearly showed the existence of a considerable environs neal gas velocity which would not exist

R-15019-2

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| Г             |            | •         | [147] [             |        | . :.  | 356¶<br>1: 0 - 0 |              |                       | ; •  | 4 |       | <u>()</u><br> | 2642  |               | /s:<br>52<br>7 | d is:    |   | i air | 4      | 7 | •••••<br> | - | 7        | ;;;<br>;; |
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१०२६ B 311) ग्च्टकार डाम. गर्का इदोड गावरच्छातालाड vs गोमछ HAPSED TER 171 1/1 200160-61, 5/1 10575182 Tested CIL 111, Cell 394, mp 11-3-64 7.7 1.7

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in the Spacecraft. The TCA would have satisfactorily completed the mission duty cycle within the temperature requirements had the hot gas recirculation not occurred.

4. Tests are being conducted to determine methods of eliminating recirculation of hot exhaust gases with resultant artificial TCA skin temperatures. The final corrective action will be implemented prior to further DAT testing.

| ٢ | FAILURE ANAL                                   | YSIS    |  |  |  |  |  |
|---|--|---------|--|--|--|--|--|
|   | ACCEPTED F.                                    | 2/18/65 |  |  |  |  |  |
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| · = •  | and Failure  | o Noport         | PART  | CHANGE                                    | CEMIN  | 1CTL N         | 326561                       |
|--|--|------------------|---|---|--|----------------|------------------------------|
| ROC  | KETDY  | N E              | E AILED DY  | TIME TO.                                  | DAT  |                |                              |
| PAR  | T IDENTIFICA   | ATION            | PAF   | RT DISPOSITI                              | ON P   | ART REPL       | ACEMENT                      |
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| 4058232  | ROCKETUYNE   | 02602            |   | DJUSTED                                   |  | SUBSTITUTE P   | ART                          |
| MONE   | NONE   | NYMI             | - 14 D EL   | IMINATED                                  | 1  | NONE           |                              |
| O MISSILE SERIAL NO.                           | SE-7   | CODE             |   |   | 37   | NONE AVAILA    |                              |
| 2 REJ. TAG NO.                                 | 13 ENG/AGE BERIAL NO.  | CODE             |   | EPOT REPAIR                               | 502  |                |                              |
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| 21 PROCEDURE—SPEC.                             | Y CHECKOV  | T SERIE          |   |   | PORTE  | -D DV          |                              |
| 25 FA  | IL TYPE 26 FAIL CODE   | 27 SECONDS 28 ST | ARTS 42 NAM   | ε   | 43   | GROUP          | 44 SUPPLEMENT                |
|  | ONTHS 30 INITIAL REPO  |                  |   | ICHTEN BURG                               | 5  | 388            | SHEET FEB 2 DA               |
| NC NC  | L  | 33               | — [   |   |  | B9             | 957                          |
| 2 OPERATION REPORTS                            |  | E 34 TIME PERIO  |   |   | جنب فستجرب بيان                                    | SIGNED         |                              |
| B [] FINAL ENG. ASSY.                          | I D LEAK & FUNC  | TION TACCEPT/RAD | , # 148 NAM   | RIA ISMI                                  |  | GROUP SOCODE   | SI PART REQ.                 |
| C   ELECMECH. CHEC<br>D   ACCEPT/RED TEST      |  | I I D PRE-TEI    | 67  | REPORT 52                                 | 7  | ATE REPORT     | 53                           |
| E   STORAGE<br>F   SHIPPING                    | L D STAT, MISS, TO   | 1 2 00-1401      | L   | JYR MO                                    | DAY  |                | VR MO DA                     |
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|  | TZER PRO   | PELLAN           | YT VAL  | VE OPER                                   | 70   |                | 78<br>B                      |
| APPROX.  |  | •                |   | VE OPER                                   | У.Е.Д.<br>31                                       |                | 78                           |
| APPROX.  | 15M8. L  | ATE. 7           | THIS V  | NE OPER                                   | У.Е.Д.<br>31                                       |                | 78                           |
| APPROX.  | 15MS L   | ATE              | THIS V.   | VE OPER<br>ALVE AL                        | У.Е.Д.<br>31                                       |                | 78                           |
| APPROX.<br>ENTLY<br>REMAIN                     | 15MS L   | ATE. 7           | THIS V.   | VE OPER<br>ALVE AL                        | У.Е.Д.<br>31                                       |                | 78                           |
| APPRÓX.<br>ENTLY<br>REMAIN                     | 15MS L   | ATE              | THIS V.   | VE OPER<br>ALVE AL                        | PPAR<br>PPAR                                       |                | 78<br>B<br>C                 |
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| APPRÓX.<br>ENTLY<br>REMAIN                     | 15MS L   | ATE              | THIS V.   | VE OPER<br>ALVE AL                        | P.P.P. 70  |                | 78<br>B<br>C<br>C            |
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#### TETOYME DIVISION OF NORTH AMERICAN AVIATION INQ.

# FAILURE ANALYSIS REPORT

· ANALYST FILL OUT COVER SHEET ONLY

| <b>OE3</b> | IDENTIFICATION |
|------------|----------------|
| Urk        | IDENTIFICATION |

OFR W. Richtenburg LOCATION 896-388 DEPT. & GROUP

CTL III

FAILURE DATE 1-9-65

PART IDENTIFICATION

| 1   | PAAT NO.         | SERIAL NO.         | PART NAME :        | MFR. NAME  |
|-----|------------------|--------------------|--------------------|------------|
|     | 203160-61        | 4058232            | Thrust Chamber     | Rocketdyne |
| 1   | eng/age model no | ENG/AGE SERIAL NO. | TEST/OPERATION NO. |            |
| ٠ ا | SE-7             |                    | 957-011            |            |

ANALYSIS BY

OFR NO.

326561

NAME DEPT. & GROUP ANALYSIS DATE 5/26/65 896-394

Facility andlysis

IF AMALYSIS APPLIES TO MORE THAN ONE OFR INSERT ALL APPLICABLE OFR NUMBERS IN THIS SPACE

A. HISTORY 2. ANALYSIS 3. CONCLUSIONS 4. CORRECTIVE ACTION
• STATE ITEM NUMBER AND DESCRIBE • USE EXTRA SHEETS . USE EXTRA SHEETS IF NECESSARY SE SPECIFIC IN CORRECTIVE ACTION STATEMENT AND STATE EFFECTIVITY DATE AND/OR ENGINE SERIAL NUMBER WHERE APPLICABLE

## 1. History

Per the OFR, the 25# OALS Gemini TCA, DAT Unit No. 2, failed the first 50 ms pulse during a facility checkout series when the oxidizer propellant valve (P/N 407559-S/N 4054460) opened approximately 15 ms late. The valve opened satisfactorily on the remaining 4 tests of the series. This facility checkout series was in preparation for signal width and pulse repeatability at high temperatures (160°F) testing.

Following the reported malfunction an additional 180 cycles of valve operation were performed for impulse signal width tests. Also, 2560 cycles of valve operation were performed during the Mission Duty Cycle test of 160 seconds duration.

## Analysis

The TCA was removed from the facility for timing tests of the propellant valves. Energize time tests were performed on both valves per RAO220-354 para. 4.6. The energize time for the oxidizer valve was .0045 sec; energize time for the fuel valve was .0036 sec. Spec. allowable is .0065 sec maximum. Closing time was .0015 sec for the oxidizer valve, .0014 for the fuel valve. Spec. allowable is .002 sec maximum. The leakage test per RAO 220-354 para. 4.8 was performed on both valves and the leakage was less than O.1 scc He/min. .

Further failure analysis at this time would have required disassembly of the valve. The DAT program, however, was directed to continue with the TCA "as is" with concurrence of MAC.

A review of all of the test records for this TCA revealed that there were other occurrences of the valve having a delayed opening on the first pulse of a test series.

Examination of the test records for the first pulse revealed a 10 ms dolay in NTO flow and the same amount of time delay in priming the NTO feed system. The NTO propallant valve current trace akhilited an unusual dip during the opening cycle.

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FURH OF PRINCE 14

REF: OFR 32656R

## 2. Analysis (cont'd)

The TCA was received at the completion of the DAT program and the propellant valves were removed and disassembled.

Both propellant valve seats exhibited a considerable length (.020) of teflon flashing over the carrier towards the outlet due to the peening action of the ball.

There was a considerable amount of contaminant on the upstream side of the fuel valve seat. The contaminant was analyzed to the following percentages: 41% Fe. 13% Cr, 17% Ni, 19% Si, 3.4% Al, 3.0% Ag, 1.9% Mn, 0.45% Mg, 0.55% Ca, and 0.29% Cu. The Fe, Cr, and Ni could be interpreted as stainless steel and the Ni, Si, and Al are indicative of dirt. The particles ranged in size from .002 to 0.004 inches.

Upon disassembly of the NTO valve, a residue was observed on the armature outside diameter and the bobbin inside diameter. There was slight rust corrosion on the valve inlet tube area adjacent to the filter. The residue from the bobbin which appeared as a whitish crystalline substance was analyzed and revealed the following percentages: 31% Fe, 7% Cr, 1.6% Ni, 19% Si, 0.7% Mn, 0.21% Mg, 0.07% B, 0.55% Al, 0.29% Mo, 0.11% Cu, 0.016% Ag, .088% Ti, and 0.26% Ca. The analysis again shows a strong trace of stainless steel and dirt. There was an insufficient quantity for further analysis.

It is noted that these contaminants were found at the conclusion of the DAT program and can only be assumed as possibly present during the DAT program.

## 3. Conclusion

The TCA remained in the DAT program and the propellant valves were actuated approximately 2740 cycles subsequent to the reported failure. Therefore, it can only be concluded that the possible cause of the NTO valve failure was the residue buildup between the armature and the bobbin. Once the poppet has shuttled, this would permit the residue to readily disperse upon liquid contact, thus not hindering successive cycles. The residue was probably the result of improper or inadequate cleaning of the propellant valves after previous use with propellants. Because the NTO system was reportedly poorly primed, it would remove the possibility of the liquid propellant contacting and dispersing or disolving the residue prior to the first actuation of the NTO valve and thus allowing normal operation.

# 4. Corrective Action

The decontamination procedure for the Thrust Chamber Assembly Design Approval Testing was revised and released on Feb. 26, 1965. However, the #2 OANS TCA for DAT testing had completed its test program by this date and, therefore, the new procedure was utilized for the Spacecraft 6 and subs DAT program.

FAILURE ANALYSIS
ACCEPTED

Work by R.B. Mide 6/16/65

RELIABILITY DEPT. 261
MOLONNELL AIRCRAFT CORX



A DIVISION OF NORTH AMERICAN AVIATION, INC.

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# APPENDIX C

MODULE/COMPONENT LOG BOOK IDENTIFICATION
AND ACCEPTANCE TEST DATA



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STREAM TESTED A CORE THAT ARE DELLY A DUE ERO ITEM COVERED BY THIS LOG BOOK WAS MANUFACTURED, INCLUDED ALL TESTED IN ACCOMPLACE DRAWINGS, SPECIFICATION AND QUALITY ASSURANCE PROVISIONS, INSPECTION AND TEST RECORDS ARE ON FILE VERIFYING COMPLIANCE WITH APPLICABLE DRAWINGS AND SPECK IONTICES, ENCEPT AS BOTED HEREIN. QUALITY REPRESENTATIVE GOV'T INSPECTION AGENCY 1961 Q. ROCKETOYNE 208160-61 1,058233 ASSY SIL NOSA PERMITTES OF 73 (1) LB. 2 duly LOG BOOK SPECIFICS 25 AN UNABILIONIC LOG BOOK DATE GEN ORDER NO. CONTRACT NO. DWG CHG LTR THRUST CHAMBER, SERIAL NO. DATE TEM PART NO. SPEC NO. £ DAT QUALITY REPRESENTATIVE PROHIBITED BY LA ن 30052 32701-265 52-52701-265 NISSION CONTRACTOR -14 100 X MCDONNELL PART NAME ·:0161R ITLE 15 HE NY MCDC ARL H. 1 LOG BOOK ACCEPTABLE THE TRANSPORT OF THE PROPERTY OF THE ORIGINAL PERTINENT AND A THE ORIGINAL PROPERTY OF THE ORIGINAL PROPERTY OF THE ORIGINAL PORTY O END ITEM - LOG BOOK IDENTIFICATION COMPONENT VARIATIONS, AGE SENSITIVE PARTS RECORD, WEIGHT AND SERIALIZATION RECORDS. CONTRIBUTE ACCEPTANCE TESTS ARE PRESENTED IN THE PERFORMANCE DATA AND SUMMARY DATA COLORS AND ACCEPTANCE. ARE PERTINENT TO THE QUALITY CONTROL SPACE ENGINES - SPACE ENGINES TOTICH I - DELIVERABLE END ITEM ASSEMBLY LOG ECONO MEDICATION Ç islariotes . . PECORDS CONTAINED IN THIS SECTION DATE L. 356.74 TANCE TEST LOG CHATENTS BINACO AL A A . A . II. . IN A VIATION, INC. V: DELIVERANT SILLES ... E. 151 17. Space ક્રો SECTION T S R-15019-2 87

SALTIST STATES

# DELIVERABLE END ITEM (DEI)

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FOR PERMANENT RECORD. ENTRIES SUCH AS SERIALIZATION, WEIGHT, THIS LOG BOOK CONTAINS INFORMATION PERTINENT TO THE DELIVERABLE IT IS NECESSARY THAT ALL ENTRIES BE WRITTEN IN INK OR TYPED APPLICABLE MGR'S, ACCEPTANCE TEST DATA AND CALIBRATION DATA END ITEM (DEI) AS SPECIFIED HEREIN BY SERIAL NO. AND PART NO. WILL BE ENTERED BY ROCKETDYNE AT THE TIME OF DELIVERY.

MODIFICATION OR RETEST. ROCKETDYNE WILL THEN ENTER REPAIR, IT IS REQUESTED THAT THIS LOG BOOK ACCOMPANY THIS DELIVERABLE END ITEM IF THE ITEM IS RETURNED TO ROCKETOYNE FOR REPAIR, MODIFICATION AND RETEST DATA IN THIS LOG BOOK.

THE FORMAT OF PAGES IN THIS LOG BOOK SHALL NOT BE REVISED WITHOUT OBTAINING APPROVAL OF ROCKETDYNE SPACE ENGINES QUALITY CONTROL.

| 208160-61    | LB. ASSY OF 2.0                           |
|--------------|---|
| PART NO.     | ST CHAMBER, 25                            |
| 52-52701-265 | PART NAME THRUST CHAMBER, 25 LB., ASSY OF |
|              | FOREWORD SE-7 LOG BOOK                    |

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| -1501                 | 1.0   | LOG BOOK IDENTIFICATION                    |                           |  |                  |
| 19-2                  | 2.0   | Forenord                                   | •                         |  |                  |
| - N                   | 3.0   | CONTENTS                                   |                           |  |                  |
|                       | 4.0   | "ODULE/COMPONENT ASSEMBLY LOG - SECTION I  | •                         |  | 75.7             |
|                       | 4.1   | CONFIGURATION AND SERIALIZATION LOG        |                           |  |                  |
| P =3944. 1            | 4.2   | SCR VERIFICATION                           |                           |  |                  |
| det ig på et a        | 4.3   | VARIATION LOG                              | . •                       |  |                  |
| • • ':                | 4.    | REPLACEMENT LOG                            | •                         |  |                  |
| an - haar safe - wil  | 5.0   | COMPONENT ACCEPTANCE TEST LOG - SECTION II | `                         | •  | minnig - Michiel |
| ir Mariantes (        | 5.1   | COMPONENT ACCEPTANCE TEST                  |                           |  |                  |
| ii aanaanii ma        | 5.1.1 | COMPONENT ACCEPTANCE TEST                  |                           |  | -34.0° pa.ge     |
| Munaur .              | 5.1.2 | COMPONENT ACCEPTANCE TEST                  |                           |  | بطاعتها ج        |
| inter 4.              | 5.1.3 | COMPONENT ACCEPTANCE TEST                  |                           |  |                  |
| d er gang             | 5.2   | CALIBRATED PERFORMANCE DATA                | <b>↔</b>                  |  |                  |
| er day e              | 5.2.1 | CALIBRATED PERFORMANCE DATA                |                           |  |                  |
| *** . <b>***</b> ** * | 5.2.2 | CALIBRATED TROGUANCE DATA                  |                           | and the second s | er Au            |
|                       | 5.3   | INFORMATION - CONTAMINATION                | •                         | TTT MANA   |                  |
| 89                    |       |  |                           |  |                  |
|                       |       |  | 52-52701-265 PAR          | PART NO. 208160-61   |                  |
|                       |       | CONTENTS SE-7 LOG BOOK                     | PART NAME THRUST CHAMBER. | ER, 25 LB., ASSY OF 3.0  |                  |
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PART NAME THRUST CHAMBER, 25 LB., ASSY OF 208160-61 PART NO. 52-52701-265 SE-7 MODULE / COMPONENT ASSEMBLY LOG \*\*\*

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| AGE CONTROL<br>DATE OF MFG. | 2 Q 64<br>2 Q 64<br>2 Q 64<br>NO. 4058233<br>NO. 208160-61  | R, 25 LB., ASSY OF   |
| SERIAL NO.                  | 405323<br>4059279<br>8399857<br>7039387<br>9193579<br>4059525<br>4059525<br>A059525<br>A059525<br>PART  | NAME THRUST CHAMBER, |
| PART NAME                   | THRUST CHALBER, ASSY OF BODY, THRUST CHALBER, ASSY OF INJECTOR, THRUST CHALBER, ASSY OF VALVE, OXIDIZER, T/C, ASSY OF VALVE, TUEL, T/C, ASSY OF  VALVE, TUEL, T/C, ASSY OF  VALVE, TUEL, T/C, ASSY OF | 10N LOG PART         |
| REV.<br>LTR.                | DNA DNA DNA DNA DNA DNA   | 8 SERIALIZAT         |
| PART NUMBER                 | 208160-61<br>208166<br>208530-11<br>407559<br>407560  | SE- 7 CONFIGURATION  |
| 171D.<br>NO.                | R-15019-2   |                      |

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| LICA / ECP NO. | DATE        | TITLE   | DATE                        | nsp.        |
| 290-523        | 6 JAN 64    | co:ponent cleaning; provision for                                   | 30 JUNE 64                  | <b>3</b> (  |
| ₹90-9¤S<br>2   | 30 JUL 63   | TCA, ACCEPIANCE TESTS; REVISION OF                                  | 30 JUNE 64                  | 3           |
| SE6-133        | 22 APR 64   | TCA PROPELLANT VALVES; ADDITIONAL REQUIREMENTS FOR                  | 30 JUNE 64                  | <u>.</u>    |
| SEC-139        | 15 ARR 64   | PLACEMENT OF HAYNES STELLITE #3 SAND CAST ON APPROVED MATERIAL LIST | 30 JUNE 64                  | <b>(3</b> ) |
| \$56-144       | 15 APR 64   | TCA INJECTORS; REDESIGN OF  | 30 JUNE 64                  | <b>(3)</b>  |
| SE6-179        | 16 JUN 64   | TUBE STUBS; MARKING OF  | 30 JUNE 64                  | <b>(3)</b>  |
| SE6-075        | 4 FEB 64    | MAG REPORT 8518, INCORPORATION OF                                   | 30 JUNE 64                  |             |
| SE5-080        | 28 DEC 63   | THRUST CHARGER ASSEMBLIES, FARRICATION MATERIAL; APPROVAL OF        | 30 JUNE 64                  | <b>E</b>    |
| SE7-25         | 9 APR 63    | 25 LB., TCA, MOUNTING HOLES; RELOCATION OF                          | 30 JUNE 64                  |             |
| SE7-29         | 31 MAY 63   | THRUST CHAMBER ASSY., 25//; CHANGES TO                              | 30 JUNE 64                  | <b>(3</b> ) |
| se6-227        | 6 MAY 64    | 25 LB., TCA SCD's, CHANGES TO                                       | 30 JUNE 64                  | (E)         |
| SE6-085        | 30 JUL 63   | CUSTOMER TEST SURVEILLANCE; REQUIREMENT FOR                         | 30 JUNE 64                  | <b>3</b>    |
|                | ·           |   |                             |             |
| R-15019-2      |             |   |                             |             |
|                |             | DMA SERIAL NO.<br>52-52701-265 PART NO.                             | 4058233<br><b>208160-61</b> |             |
| SE-7 DE        | DELIVERABLE | END ITEM - MGR VERIFICATION PART NAME THRUST CHAMBER, 25            | LB., ASSY OF                | 4.2         |
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|---|-----------------------|-----------------|----------------------|-----------------|
|   |                       |                 | 233                  | ASSY OF 4       |
|   | MATERIAL              |                 | 4058233<br>208160-61 |                 |
|   | AND MA                |                 | NO.                  | sr, 25 lb.,     |
|   | VARIATION AND I       |                 | SERIAL NO.           | THRUST CHAMBER, |
|   | OF VARI<br>BOARD      | ేరే<br>జ        | 365                  | THRUS           |
| • |                       | 3 1 JULY 64     | DNA<br>52-52701-265  | NAME            |
|   | DESCRIPTION<br>REVIEW | NONE THIES DATE | 25                   | PART            |
|   | BRIEF (               | NONE T          | · ··•                | **** <u>**</u>  |
|   |                       |                 |                      | L06             |
|   | ERIAL<br>Imber        |                 |                      | NATION          |
| · | S                     |                 |                      | - VAR           |
|   | PART<br>NUMBER        |                 |                      | ) ITEM          |
|   |                       |                 |                      | END             |
|   | ART OR COMP.          |                 |                      | DELIVERABLE     |
|   | PART (                | ,               |                      | ב סברות         |
|   | 9.                    |                 |                      | SE- 7           |
|   | M M N                 | R-15019-2       | 93_                  |                 |

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| INSP.                         |                          |                        | 4.4                       |
|-------------------------------|--------------------------|------------------------|---------------------------|
| REPLACED BY<br>NO. SERIAL NO. |                          | 4056233<br>203102-01   | .8., ASSY CF              |
| REPLA<br>PART NO.             |                          | SENIAL HO.<br>PANT NO. | TIRUST CHANDER, 25 LB.    |
| reason for Replacement        | NOXE THIS DATE 1 JULY 64 | DM<br>52-52701-265     | PART HAUE                 |
| SERIAL NO.                    |                          |                        | REPLACEMENT LOG           |
| PART NALLE                    |                          |                        | DELIVERABLE END ITEM REPL |
| PART NO.                      | 94 R-15019-2             |                        | SE-7 DE                   |

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Signature of

|           |                    | 5.0                               |
|-----------|--------------------|-----------------------------------|
|           | PART NO. 208160-61 | THRUST CHAMBER, 25 LB., ASSY OF 5 |
|           | 52-52701-265       | PART NAME THRUST                  |
| SECTION I |                    | TEST LOG                          |
|           |                    | ACCEPTANCE TES                    |
|           |                    | 101000 Fill 1000000 Fill 100      |

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| S PERFORMANCE PARAMETERS   | PARAGRAPH<br>NUMBER | UNITS               | SPECIFICATION<br>LIMITS | ACCEPTANCE<br>TEST DATA | INSP.      |
|--|---------------------|---------------------|-------------------------|-------------------------|------------|
| ELECTRICAL RESISTANCE TESTS  | 4.2                 |                     |                         |                         |            |
| VALVE BODY TEMPERATURE   | 4.2.4               |                     |                         |                         | (A)        |
| OXIDIZER   |                     | A SARUDAD           | 70 ± 5                  | . 71                    | (£3)       |
| FUEL   |                     | DEGREES ?           | 70 ± 5                  | 77                      | <b>(3)</b> |
| VALVE COIL RESISTANCE  | 4.2.5               |                     |                         |                         | (          |
| OXIDIZER   |                     | OIRIS               | 42 + 2                  | 40.85                   |            |
| FUEL   |                     | Oinas               | 42 ‡ 2                  | 41.71                   |            |
| CONTINUITY RESISTANCE  | 4.2.9               |                     |                         |                         | ) (        |
| OXIDIZER   | •                   | Oints               | 1.0 MAX.                | 0.186                   | 3          |
| FUEL   |                     | OHEKS               | 1.0 MAX.                | 0.143                   | (53)       |
| DIELECTRIC STRENGTH TEST   | 4.3                 |                     |                         |                         | )          |
| CURRENT LEAKAGE  |                     |                     |                         |                         | (2)        |
| OXIDIZER   | 4.3.8               | MICRO AMPS          | 500 MAX.                | 4                       | 3          |
| FUEL   | 4.3.8               | MICRO AMPS          | 500 MAX.                | 33                      |            |
| PROOF PRESSURE TEST - TCA PROPELLANT VALVES  | 4.4                 |                     |                         |                         | . (        |
| VALVE PRESSURIZED FOR MINIMUM OF  3 MINUTES AT 500 ± 10 PSIG   | 4.4.3               | DVA                 | VERIFY                  | VERIFIED                | <b>3</b>   |
| VALVE DE-PRESSURIZED AND VALVE HOUSING INSPECTED   | 4.4.4               | DNA                 | VERIFY                  | VERIFIED                |            |
| PARAGRAPHS 4.4.3 AND 4.4.4 REPEATED  | 4.4.5               | DNA                 | VERITY                  | VERIFIED                |            |
| 92   |                     |                     | •                       |                         |            |
| hevision avenduent specification no spec | NUMBER              | DNA<br>52-52701-265 | SERIAL NO.              | 4058233<br>208160-61    |            |
| SE-7 COMPONENT ACCEPTANCE TEST   | PAF                 | PART NAME TIRU      | THRUST CHAMBER, 25 I    | LB., ASSY OF            | 5.1        |
|  |                     |                     |                         |                         |            |

| •   |                     |               |                         |                         |          |
|---|---------------------|---------------|-------------------------|-------------------------|----------|
| PERFORMANCE PARAMETERS  | PARAGRAPH<br>NUMBER | UNITS         | SPECIFICATION<br>LIMITS | ACCEPTANCE<br>TEST DATA | INSP.    |
| PROOF PRESSURE TEST - TCA PROPELIANT VALVES (CONTINUED) CONFORMANCE TO PARAGRAPHS 4.4.3, 4.4.4, AND |                     |               |                         | . •                     |          |
| 4.4.5 VEHIFIED OXIDIZER   | •                   | . <b>Y</b> XQ | VERIFY                  | VERIFIED                |          |
| FUEL  |                     | DNA           | VERIFY                  | VERIFIED                |          |
| PROOF PRESSURE AND LEAKAGE TEST - TIMUST CHANDER  | 4.5                 |               |                         |                         | ) (      |
| · CILAMBER PRESSURIZED FOR A MINIMUM OF 5 MINUTES AT 392 \$\pm\$ 10 PSIG. NO LEAKAGE DETECTED       | 4.5.8               | DNA           | Verify                  | VERIFIED                |          |
| CHAMBER DE-PRESSURIZED AND PARACRAPH 4.5.8 REPEATED   | 4.5.8               | DNA           | VERIFY                  | VERIFIED                | <b>S</b> |
| TCA INSPECTED VISUALLY FOR DAMAGE OR DEFOUNTION   | 4.5.14              | DKA           | VERIPY                  | VERIFIED                |          |
| FUNCTIONAL TEST - TCA PROPELLANT VALVES   | 4.6                 |               |                         |                         |          |
| OPENING RESPONSE TIME   | 4.6.8               |               |                         |                         | (A.)     |
| OXIDIZER  |                     | SEC.          | .0065 MAX.              | .0036                   | <u> </u> |
| FUEL  | -                   | SEC.          | .0065 MAX.              | 700*                    |          |
| CLOSING RESPONSE TIME   | 4.6.10              |               |                         |                         |          |
| OXIDIZER  |                     | SEC.          | .002 MAX.               | 7100.                   | <b>3</b> |
| FUEL  |                     | SEC.          | . 002 MAX.              | .0017                   |          |
| CLOSING DROP OUT VOLTAGE  | 4.6.13              |               |                         |                         | - C      |
| OXIDIZER  |                     | VOLT (DC)     | 1 MIN.                  | 2.5                     |          |
| FUEL  | ,                   | VOLT (DC)     | 1 MIN.                  | 1.5                     | -<br>(3) |
|   |                     | DNA           | SERIAL NO.              | 4,058233                |          |
| #3 RA0220-354   | NOMBEN I            | 52-52701-265  |                         | 208160-61               |          |
| SE- 7 COMPONENT ACCEPTANCE TEST   | PA                  | PART NAME THE | TIRUST CHAMBER, 25.,    | ., ASSY OF              | 5.1.1    |
|   |                     |               |                         |                         |          |

| ø.                      | ·                                    |                   |               | <u>ر</u>      |                |            | ~~~~                             | ·                           |                     |          |             |                    |                                     |  | <del></del>                                      |  |   | 1                    | 1            | 5.1.2                     | 1 |
|-------------------------|--------------------------------------|-------------------|---------------|---------------|----------------|------------|----------------------------------|-----------------------------|---------------------|----------|-------------|--------------------|-------------------------------------|--|--|--|---|----------------------|--------------|---------------------------|---|
| INSP.                   |                                      | (¢)               |               | ( <u>3</u> )  | E              | 3          | <b>3</b>                         |                             | <b>3</b>            | <b>3</b> | <b>(3</b> ) |                    |                                     | <b>3</b> (   | <b>3</b>   | <b>(3)</b>                                       |   |                      |              | 5.                        |   |
| ACCEPTANCE<br>TEST DATA |                                      |                   | LESS THAN 0.1 | LESS THAN 0.1 |                | 3.35       | 2.218                            | .358                        | .358                | .358     | .358        |                    |                                     | VERIFIED   | VERIFIED   | VERIFIED   |   | 4058233              | 208160-61    | LB., ASSY OF              |   |
| SPECIFICATION<br>LIMITS |                                      |                   | 2.21 MAX.     | 2.21 MAX.     |                | DNA        | DNA                              | DXA                         | DNA                 | DNA      | <b>P</b> NQ |                    |                                     | VERIFY   | Veripy   | VERIFY   |   | SERIAL NO.           | PART NO.     | THRUST CHAMBER, 25        |   |
| UNITS                   |                                      |                   | SCC/MIN       | SCC/HIN       |                | rg.        | INCH                             | INCH                        | INCH                | INCH     | INCH        |                    | •                                   | DNA  | DNA  | DNA  |   | DNA                  | 52-52701-265 | PART NAME TIR             |   |
| PARAGRAPH<br>Number     | 4.8                                  | 4.8.16            | 4.8.17        | 4.8.17        |                | 4.1.3      | -                                |                             | •                   |          |             | .;                 | 4.5                                 | 4.5.8  | 4.5.8  | 4.5.14   |   | BARNIN               |              | A                         |   |
| ETERS '                 |                                      |                   |               |               |                |            |                                  | •                           |                     |          |             |                    | THRUST CHAMBER                      | and of 5 minutes<br>detected   | Graph 4.5.8                                      | GE OR DEFORMATION                                | • | IN NOLLY JIELJEAS    | RA0220-354   | ANCE TEST                 |   |
| PERFORMANCE PARAMETERS  | LEAKAGE TEST - TCA PROPELIANT VALVES | SEAT LEAKAGE RATE | OXIDIZER      | FUEL          | PICE-TEST DATA | DRY WEIGHT | NOZZLE EXIT DIAMETER SECTION A-A | THROAT DIAMETER SECTION A-A | <b>m</b> - <b>d</b> | ပ        | Q-Q         | POST HOT-FIRE DATA | PROOF PRESSURE AND LEAKAGE TEST - 1 | CHAMBER PRESSURIZED FOR A MINIMUM OF 5 AT 392 ± 10 PSIG. NO LEAKAGE DETECTED | CHAMBER DE-PRESSURIZED AND PARAGRAPH 4. REPRATED | TCA INSPECTED VISUALLY FOR DAMAGE OR DEFORMATION |   | LUVI SION AMENDIAENT | . Dil        | SE-7 COMPONENT ACCEPTANCE |   |

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|      | -                       | , , , , , , , , , , , , , , , , , , ,  |  |                                  |  | •                        |   |          |
|------|-------------------------|--|--|----------------------------------|--|--------------------------|---|----------|
| •    | INSP.                   |  | <b>3</b> .9  | <b>3 9</b>                       | <b>9909</b>  |                          | 5.1.3   | <b>–</b> |
|      | ACCEPTANCE<br>TEST DATA | less than 10-6<br>less than 10-6   | LESS THAN 0.1<br>LESS THAN 0.1   | 3,15                             | .350<br>.34 <i>97</i><br>.350<br>.3498   | 3.09                     | 4,058233<br>208160-61<br>1 LB., ASSY OF   |          |
|      | SPECIFICATION<br>LIMITS | 10 <sup>-6</sup> MAX.<br>10 <sup>-6</sup> MAX.                                     | 2.21 MAX.<br>2.21 MAX.   | DNA ·                            | YNG<br>DNA<br>YNG  | • DNA                    | PART NO. THRUST CHAMBER, 25   |          |
|      | UNITS                   | coc/sec  | cos/cos  | LB.                              | INCH<br>INCH<br>INCH   | .EB.                     | DNA<br>52701-265<br>NAME  |          |
|      | Paragraph<br>Number     | 4.17.5<br>4.17.6<br>4.17.8   | 4.17.9<br>4.8.16<br>4.8.17<br>4.8.17   | 4.17.1<br>1.18.1                 |  | 4.18.2                   | _ ' '   a   |          |
|      | PERFORMANCE PARAMETERS  | LEAK TESTWELDED JOINTS  LEAK TESTWELDED JOINTS  LOINT LEAKAGE RATE  OXIDIZER  FUEL | LEAKAGE TEST-TCA PROPELLANT VALVES SEAT LEAKAGE RATE OXIDIZER FUEL                 | NOZZLE EXIT DIAMETER SECTION A-A | SECTION A-A B-B C-C D-D  | DRY WEIGHT (DELIVERABLE) | SPECIFICATION NUMBER REVISION AMENDMENT  S RAO220-354 NG #3  SE-7 COMPONENT ACCEPTANCE TEST |          |
| ~~~~ |                         | R-15019-2  | B ( m <sup>ar</sup> language agentification with the street r <sub>e</sub> player. | 400 Automorphism Automorphism    | رند بالد دائل در بروهای کانتان الله کانتان داد و ۱۰ در دارد بازی کانتان کانتان کانتان کانتان کانتان کانتان کان | Transpir station (c) may | 1 19  |          |

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| 100  | CHARACTERISTICS                | UNITS              | SPECIFICATION<br>LIMITS | RUN<br>TEST DATA | RUN<br>TEST DATA | RUN<br>TEST DATA | RUN 158<br>FINAL TEST<br>DATA | INSP.      |
|------|--------------------------------|--------------------|-------------------------|------------------|------------------|------------------|-------------------------------|------------|
|      | HOT FIRE TEST DATA - TEST SITE |                    |                         | ·                | •                | 1                | NFL                           |            |
|      | CELL LOCATION                  | 1                  | •                       | •                | •                |                  | 379                           | 3          |
|      | CELL NUIDER                    | •                  |                         |                  | •                | •                | J-1                           | (3)        |
|      | TEST DATE                      | 1                  | •                       | •                | •                | •                | 15 JUN 64                     |            |
|      | TEST DURATION                  | SEC.               | 2 MIN.                  | 1                |                  | •                | 3.0                           | (3)        |
|      | ENVIRONGENTAL PC               | PSIA               | .16 MAX.                | •                | 9                | •                | .0622                         |            |
|      | AMBIENT PRESSURE               | PSIA               | DNA                     | 1                | . 1              |                  | 12.04                         | <b>(3)</b> |
|      | AMBIENT TEMPERATURE            | o <sub>F</sub>     | DNA                     | 1                | 1                |                  | 63.0                          | <b>3</b>   |
|      | TIME OF DATA SLICE-START       | SEC.               | DNA                     | •                | •                | •                | 2.8                           |            |
|      | TIME OF DATA SLICE-END         | SEC,               | DNA                     | •                | •                | •                | 2.8                           |            |
|      | OXIDIZER TEMPERATURE           | ď                  | DKA                     | •                | •                | •                | 53.5                          |            |
| L    | FUEL TEMPERATURB               | <b>d</b> o         | DNA                     | •                | •                |                  | 1,8.5                         |            |
| l.   | OXIDIZER DENSITY               | LB/FT <sup>3</sup> | DNA                     | ð                | •                | 1                | 91.85                         |            |
| i    | FUEL DENSITY                   | LB/FT <sup>3</sup> | DNA                     | 1                | ı                | 1                | 54.65                         | (Fig.)     |
|      |                                |                    |                         |                  |                  |                  |                               |            |
| R=15 |                                |                    |                         |                  | •                |                  |                               |            |
| 019= | ACTISION AMENDMENT *           | SPECIFICA          | FICATION NUMBER         |                  | DIVA SE          | SERIAL NO.       | 1,058233                      |            |
| 2    | 2/8                            | * RA0220-354       | 354                     | 52-52701-265     |                  | PART NO.         | 203160-61                     | -          |
|      | SE-7 (REA) CALIBRATED PER      | PERFORMANCE        | DATA                    | PART NAME        | THRUST           | CHAMBER, 25 I    | LB., ASSY OF                  | 5.2        |
|      |                                |                    | ·                       |                  |                  |                  | A                             |            |

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|   | 4                             |                                |                         |                     |                   |               |        |               |                  |                 |                         |                 |                       |                           |                         |                        |                    |   |                           |     |
|---|-------------------------------|--------------------------------|-------------------------|---------------------|-------------------|---------------|--------|---------------|------------------|-----------------|-------------------------|-----------------|-----------------------|---------------------------|-------------------------|------------------------|--------------------|---|---------------------------|-----|
|   | INSP.                         |                                |                         |                     |                   |               |        |               |                  |                 | (3)                     |                 | (3)                   |                           | (3)                     | (3)                    |                    |   | 5.2.1                     |     |
|   | RUN 159<br>FINAL TEST<br>DATA | TEN                            | 2°†ó2                   | 289.8               | .0462             | .0351         | 23.3   | 1.32          | 287.             | 135.7           | 5409.                   | .358            | 00140.                | 54650.                    | 3.0                     | 238.                   | 239.               | 4058233<br>208160-61                                | , ASSY OF                 |     |
|   | RUN<br>TEST DATA              | •                              |                         | •                   | 8                 | •             | •      | •             | •                |                 | •                       | •               | •                     | •                         | •                       | •                      | •                  | SERIAL NO   | CHAMBER, 25 LB.,          |     |
|   | RUN<br>TEST DATA              | 2                              | •                       | •                   |                   | •             |        | •             | •                | •               | •                       | •               | ŧ                     | 1                         | •                       | ••                     | •                  |   | TIRUST                    |     |
|   | RUN<br>TEST DATA              | 1                              |                         | 1                   | 1                 | 8             |        |               | 8                | •               | 1                       | 1               | •                     | •                         | •                       | •                      | •.                 | 52-5270   | PART NAME                 |     |
|   | SPECIFICATION<br>LIMITS       | •                              | 292 ± 10                | 292 ± 10            | DNA               | DNA           | DNA    | DNA           | DNA              | DNA             | DNA                     | DIVA            | DNA                   | ANG.                      | 10 MAX.                 |                        |                    | TION NUMBER   | DATA                      | -   |
|   | UNITS                         | 8                              | PSIA                    | PSIA                | LB/SEC.           | LB/SEC.       | LB.    | 9/P           | SEC.             | PSIA            | FT/SEC.                 | IN.             | IN.                   | • ии                      | *Das                    | •                      | •                  | SPECIFICATION * RA0220-354                          | PERFORMANCE               |     |
| • | CHARACTERISTICS               | not fire test data – test site | OXIDIZER INLET PRESSURB | FUEL INLET PRESSURE | OXIDIZER FLOWRATE | FUEL FLOWRATE | TirusT | MIXTURE RATIO | SPECIFIC IMPULSE | INJECTOR END Pc | CIMPACTERISTIC VELOCITY | THROAT DIAMETER | FUEL ORIFICE DIALETER | OXIDIZER CRIFICE DIAMETER | TCA FIRING TIME (TOTAL) | OXIDIZER SAMPLE NUMBER | FUEL SAMPLE NUMBER | ANEADAIDATENT * * * * * * * * * * * * * * * * * * * | SE-7 (REA) CALIBRATED PER | . ' |
|   | R-15019-                      | -2                             |                         |                     |                   |               |        |               |                  |                 |                         |                 | <b></b>               | <b></b>                   | L                       | 1                      | ـــــــا           | 101   | ا                         | l   |

| CHARACTERISTICS                | UNITS                                     | SPECIFICATION RUN                      | RUN<br>TEST DATA | RUN<br>TEST DATA     | RUN<br>TEST DATA | RUN 159<br>FINAL TEST<br>DATA | INSP.                      |
|--------------------------------|---|--|------------------|----------------------|------------------|-------------------------------|----------------------------|
| HOT FIRE TEST DATA - TEST SITE | 1   | •                                      | 1                |                      | •                | NFL                           |                            |
| ADJUST TO STANDARD CONDITIONS  | 1   | •                                      | •                | 1                    | 1                | •                             |                            |
| TIRUST                         | LB.                                       | 23 ± 1.2                               | ı                | ,                    | •                | 23.4                          |                            |
| MIXTURE RATIO                  | 9/6                                       | 1.30 ± .04                             | 8                | ŧ                    | ı                | 1.29                          | <b>(3)</b>                 |
| SPECIFIC IMPULSE               | SEC.                                      | DNA                                    | 1                |                      | 1                | 289.                          |                            |
| INJECTOR END Pc                | PSIA                                      | DNA                                    | .t               | 1                    | •                | 134.9                         |                            |
| CIMPACTERISTIC VELOCITY        | FT/SEC.                                   | DNA .                                  |                  | ŧ                    | 1                | 5399.                         |                            |
| ADJUST TO RATED CONDITIONS     |   | -                                      | 1                |                      | •                | •                             |                            |
| THUST                          | LB.                                       | 23                                     | ,                | •                    | •                | 23.0                          |                            |
| MIXTURE RATIO                  | 0/F                                       | 1.3                                    |                  | 1                    | •                | 1.30                          |                            |
| SPECIFIC IMPULSE               | SEC.                                      | 272 MIN.                               |                  | •                    | •                | 289.                          | <b>3</b>                   |
|                                |   |  |                  |                      |                  |                               |                            |
|                                |   | ~                                      |                  |                      |                  |                               |                            |
|                                |   |  |                  |                      |                  |                               |                            |
|                                |   |  |                  |                      |                  |                               |                            |
|                                |   |  | ·                |                      | :                |                               |                            |
|                                | 7 0 10 10 10 10 10 10 10 10 10 10 10 10 1 | PANIN NOIT                             | a                | DNAS                 | SERIAL NO.       | 4058233                       |                            |
| 1,4 1/C #1                     | *<br>*<br>RA0220-354                      | ************************************** |                  | 52-52701-265         | PART NO.         | 208160-61                     |                            |
| 7 (REA) CALIBRATED             | PERFORMANCE                               | DATA                                   | PART NA          | NAME THRUST CHANDER, | 25               | LB., ASSY OF                  | 5.2.2                      |
|                                |   | •                                      |                  |                      |                  |                               | <i>( ( ( ( ( ( ( ( ( (</i> |

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|---|---|
| PROPELLAN   |   |
| THE   |   |
| Q   | •   |
| LEVEL   | SEMBLY  |
| CLEANLINESS   | T CHAMBER AS  |
| O THE   | THRUS   |
| WELATIVE T  | rest of The   |
| INFORMATION   | ACCEPTANCE 7  |
| THE FOLLOWING IS INFORMATION RELATIVE TO THE CLEANLINESS LEVEL OF THE PROPELLANT UTILIZED | IN THE HOT-FIRE ACCEPTANCE TEST OF THE THRUST CHAMBER ASSEMBLY. |

THE INFLUENT PARTICULATE COUNT OF THE PROPELLANT WAS:

| •                     | ACTUAL COUNT | NTO - OXID | DIVA     | 7.1     | 11      | 3  | 0 | 0    | 0   | 0      | 0      |  |
|-----------------------|--------------|------------|----------|---------|---------|----|---|------|-----|--------|--------|--|
|                       | ACTUAL COUNT | MMH - FUEL | DNA      | 63      | 7       | 5  | 7 | 0    | 0   | 0      | 0      |  |
|                       | LIMITS       |            |          | 8       | 50      | ٠. | ı |      | 0   | 0      |        |  |
|                       |              |            | *        |         | 0       | 8  | 8 | 0001 | 000 | 000    | 000    |  |
| TINY THE              |              | ,          | ۲<br>کار | 10 - 25 | 25 - 50 | •  | • | 1    | •   | •      | •      |  |
| AL THE LINE LOCAL TAR |              |            |          |         |         |    |   |      |     | FIBERS | FIBERS |  |

" NOT TO BE COUNTED BUT NO SLUTRY OF FINE PARTICLES WHICH COVERS MORE THAN AN ESTIMATED 5 PERCENT OF THE TOTAL EFFECTIVE FILTER AREA SHALL BE ALLOWED." AT THE DISCRETION OF QUALITY ASSURANCE, A WEIGHT DETERMINATION OF TOTAL CONTAMINATION MAY BE MADE AS A REFEREE TEST IN BORDERLINE CASES. THE MAXIMUM ALLOWABLE WEIGHT OF CONTAMINANTS SHALL \* NOTE:

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|   |                     |              | 5.3                                       |
|---|---------------------|--------------|---|
|   |                     | 208160-61    | lb., assy of                              |
|   |                     | o<br>N       | B, 25                                     |
|   |                     | PART NO.     | CHAMBE                                    |
|   | ,                   | 52-52701-265 | PART NAME THRUST CHAMBER, 25 LB., ASSY OF |
|   | AMENDMENT           | 1#           |   |
|   | REVISICE            | ф            | CONTAMINATION                             |
|   | CESTRICATION NUMBER | 3.615-003    | SE-7 INFORMATION - CONTAMINATION          |
| i |                     |              | İ   |

CERTIFICATION IS HEREDY GIVEN THAT THE DELIVERABLE END ITEM COVERED BY THIS LOG BOOK WAS MANUFACTURED, INSPECTED AND TESTED IN ACCORDANCE WITH PRESCRIBED DRAVINGS, SPECIFICATION AND QUALITY ASSURANCE PROVISIONS. HISPECTION AND TEST RECORDS ARE ON FILE VERIFYING COMPLIANCE WITH APPLICABLE DRAVINGS AND SPECIFICATIONS, EXCEPT AS NOTED HEREIN."

|                              | 100 BOOK                             | LOG BOOK ACCEPTANCE DAT #4 (DRD #4)  | ነው #ኒ.)   |
|------------------------------|--------------------------------------|--------------------------------------|---|
| SPACE ENGINES<br>ENGINEERING | SPACE ENGINES<br>QUALITY CONTROL     | MC DONNELL<br>QUALITY REPRESENTATIVE | GOV'T INSPECTION AGENCY<br>QUALITY REPRESENTATIVE |
| DATE IS DOLY 1964            | S. 19. (Juliary<br>DATE 15 3044 1964 | DATE 15 TE                           | Cr 1964 DATE 15 3.14 1964.                        |

#### CONTENTS

SPECIFICS

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## SECTION I - DELIVERABLE END ITEM ASSEMBLY LOG

RECORDS CONTAINED IN THIS SECTION ARE PERTINENT TO THE SELIVERABLE END ITEM ACCEPTANCE AND ALSO INCLUDE MODEL CONFIGURATION DATA, PERTINENT DETAILS OF SHORT SHIPMENTS, COMPONENT VARIATIONS, AGE SENSITIVE PARTS RECORD, WEIGHT AND SERIALIZATION RECORDS.

### SECTION II - ACCEPTANCE TEST LOG

RECORDS OF ASSEMBLY ACCEPTANCE TESTS ARE PRESENTED IN THIS SECTION WITH PERFORMANCE DATA AND SUMMARY DATA ON INSPECTIONS AND ACCEPTANCE.

#### GENERAL INFORMATION

THIS LOG BOOK IS PROVIDED FOR SERVICE USE IN RECORDING PERTINENT HISTORICAL DATA AND ALL CHANGES FROM THE ORIGINAL CONFIGURATION. IT IS REQUESTED THIS LOG BOOK ACCOMPANY THE DELIVERABLE END ITEM WHEN TRANSFERRED BETWEEN ROCKETDYNE AND USING AGENCIES.

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# DELIVERABLE END ITEM - LOG BOOK IDENTIFICATION

SE-7

#### ROCKETDYNE 3 208160-61 4058232 DNA 5252 AFFECTORG STATES GE CAWS 15 TRANS FERSON IS 12 AINS INFORMATION ASE OF THE COME OF THE CO LOG BOOK DATE GEN ORDER NO. CONTRACT NO. DIVG CHG LTR SERIAL NO. TEM SPEC NO. PART NO. HIS MATERIAL CON A ME NATIONAL DE NATIONAL DE NATIONAL DE NATIONAL SIGNAL SIGNAL MATERIAL NATIONAL MACHINE BY LAW. SCD52-52701-265 52-52701-265 Y-20161R DNA

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CHAMBER,

PART NAME THRUST

# DELIVERABLE END ITEM (DEI)

FOR PERMANENT RECORD. ENTRIES SUCH AS SERIALIZATION, WEIGHT, THIS LOG BOOK CONTAINS INFORMATION PERTINENT TO THE DELIVERABLE IT IS NECESSARY THAT ALL ENTRIES BE WRITTEN IN INK OR TYPED APPLICABLE MCR'S, ACCEPTANCE TEST DATA AND CALIBRATION DATA END ITEM (DEI) AS SPECIFIED HEREIN BY SERIAL NO. AND PART NO. WILL BE ENTERED BY ROCKETDYNE AT THE TIME OF DELIVERY.

MODIFICATION OR RETEST. ROCKETOYNE WILL THEN ENTER REPAIR, IT IS REQUESTED THAT THIS LOG BOOK ACCOMPANY THIS DELIVERABLE END ITEM IF THE ITEM IS RETURNED TO ROCKETDYNE FOR REPAIR, MODIFICATION AND RETEST DATA IN THIS LOG BOOK.

THE FORMAT OF PAGES IN THIS LOG BOOK SHALL NOT BE REVISED WITHOUT OBTAINING APPROVAL OF ROCKETDYNE SPACE ENGINES QUALITY CONTROL.

|                        | 52-52701-265                              | PART NO.       | 203160-61 |     |
|------------------------|---|----------------|-----------|-----|
| FOREWORD SE-7 LOG BOOK | PART HAME THRUST CHANDER, 25 LB., ASSY OF | CHAMBER, 25 LF | ASSY OF   | 2.0 |
|                        |   |                |           |     |

|          | <del></del>    |  |                  | <u> </u>  |  |  | با جيا جسي  |             |             |             |              |            | et Streege († 1925) | )           |             | 3.0                            |
|----------|----------------|--|------------------|---|--|--|-------------|-------------|-------------|-------------|--------------|------------|---------------------|-------------|-------------|--------------------------------|
| ·        |                |  |                  |   |  |  | •           |             |             |             |              |            |                     |             | 208160-61   | , ASSY OF                      |
|          |                |  | •                |   |  |  |             |             |             |             |              |            |                     |             | ART NO.     | снамвек, 25 гв.,               |
|          |                |  |                  | •   |  |  |             |             |             |             |              | ٠          |                     |             |             | TIRUST CH                      |
| •        | •              |  |                  |   |  | •  |             |             |             |             |              |            |                     |             | 52-52701-26 | PART NAME                      |
|          |                |  |                  |   |  | •  |             |             |             |             |              |            |                     | <del></del> |             |                                |
|          | TION I         |  |                  |   | •  | TION II  |             |             |             |             |              |            |                     |             |             | BOOK                           |
| •        | 7 10G - SEC    | LIZATION LOG                                       |                  |   |  | 1  | <b>t</b> s  | 25          | . Ls        | ST          | DATA         | DATA       | DATA                | rion        |             | SE-7 LOG                       |
|          | ENT ASSEMBI    | N AND SERIAI                                       | rion             | <b>.</b>  | 5071   | CEPTANCE TES   | CEPTANCE TE | CEPTANCE TE | CEPTANCE TE | CEPTANCE TE | ERFORMANCE ! | ERFORMANCE | ERFORTANCE .        | - CONTAMINA |             | CONTENTS                       |
|          |                |  | -                | Š   | Ë  | Ā  | , AC        | r Ao        | T AC        | T AC        | ED P         | ED P       | 12                  | NO.         | 1           |                                |
| CONTENTS | MODULE/CO: TO: | CONFIGURATIO                                       | KCR VERIFICATION | VARIATION LOG   | REPLACEMENT LOG                                    | COMPONENT  | CCHEONENT   | COLIPONENT  | COMPONEN    | COMPONEN    | CALIERAT     | CALIBRAT   | CALIBRAT            | INFORMAT    |             |                                |
|          |                | CONTENTS MODULE/COMPONENT ASSEMBLY LOG - SECTION I | 23 SEC           | ent assembly log - section i<br>and serialization log | ent assembly log - section I And serialization log | ant assembly log - section I  And serialization log  Ion | TION        | TION        | TION        | FION        | TION         | TION       |                     | FION        |             | TION II  12-52701-265 PART NO. |

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|           | PART RI | PART NAME THRUST CHAMBER, 23 LD., ASSI CA |
|-----------|---------|---|
| SECTION I |         | SE-7 MODULE / COMPONENT ASSEMBLY LOG      |

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|          | PART NAME  | SERIAL NO.                           | AGE CONTROL<br>DATE OF MFG. | INSP.         |
|----------|--|--------------------------------------|-----------------------------|---------------|
| YOOZ YOU | Timust Cimidea, 25 lb., Assy of                              | 4058232                              | 2064                        | <b>®</b> (    |
| DNA      | DODY, THRUST CHALBER, ASSY OF SIELL, THRUST CHALBER, ASSY OF | 689984 <b>6</b>                      | non z                       |               |
| 11.      | INJECTOR, THRUST CHALMER, ASSY OF                            | 70h2726                              |                             |               |
| DNA      | VALVE, OXIDIZER, T/C, ASSY OF                                | 09717507                             |                             | <b></b>       |
| ANG      | VALVE, FUEL, T/C, ASSY OF                                    | 4055162                              | •                           | ( <u>ja</u> ) |
| •        |  |                                      |                             | /s            |
|          | 52-52  | DNA SERIAL NO. 52-52701-265 BAST NO. | NO. 1058232 V               | I             |
|          |  | THRUST                               | 25                          | 4.1           |

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|-----------------|-------------|---|----------------|-------------|
| MCR / ECP NO.   | DATE        | TITLE   | DATE           | 1138        |
| SE6-062         | 6 JAN 64    | COMPONENT CLEANING; PROVISION FOR                                   | 15 JULY 64     | (3)         |
| SE6-064         | 30 JUL 63   | TCA, ACCEPTANCE TESTS; REVISION OF                                  | 15 JULY 64     |             |
| SE6-133         | 22 APR 64   | TCA PROPELLANT VALVES; ADDITIONAL REQUIREMENTS FOR                  | 15 wer 64      | <b>(3)</b>  |
| SE6-139         | 15 APR 64   | PLACEMENT OF HAYNES STELLITE #3 SAND CAST ON APPROVED MATERIAL LIST | 15 JULY 64     | <b>(</b> )  |
| ग्रां-९३ऽ       | 15 APR 64   | TCA INJECTORS; REDESIGN OF  | 15 JULY 64     | <b>(3)</b>  |
| SE6-179         | 16 vur 64   | TUBE STUBS; MARKING OF  | 15 JULY 64     | (E)         |
| \$20-92S        | 2 JUL 64    | MAC REPORT 8518, INCORPORATION OF                                   | 15 JULY 64     | <b>(</b> )  |
| SE6-080         | 28 DEC 63   | THRUST CHAMBER ASSEMBLIES, FABRICATION MATERIAL; APPROVAL OF        | 15 JULY 64     |             |
| SE7-25          | 9 APR 63    | 25 LB. TCA, MOUNTING HOLES; RELOCATION OF                           | 15 JULY 64     | <u>(i)</u>  |
| SE7-29          | 31 MAY 63   | THRUST CHANDER ASSY., 25#; CHANGES TO                               | 15 JULY 64     | <b>(a)</b>  |
| SE6-227         | 6 max 64    | 25 LB. TCA SCD'S, CHANGES TO  | 15 outs 64     | <b>(37)</b> |
| SE6-085         | 30 JUL 63   | CUSTONER TEST SURVEILLANCE; REQUIREMENT FOR                         | 15 JULY 64     |             |
| *a-Audolphiloso |             |   |                |             |
|                 |             |   |                | Asia Cart   |
|                 |             | DNA SERIAL 110.<br>52-52701-265 PART NO.                            | 4058232        |             |
| SE-7 D          | DELIVERABLE | END ITEM-TICR VERIFICATION PART NAME THRUST CHAMBER, 25             | S LB., ASSY OF | 4.2         |
|                 |             |   |                |             |

| INSP.   | <b>3</b>     |  |              |                    |   |    |   |                                       |   |             |                     | A Sec.      |                         |                                 | 4.3                                       |
|---|--------------|--|--------------|--------------------|---|----|---|---------------------------------------|---|-------------|---------------------|-------------|-------------------------|---------------------------------|---|
| BRIEF DESCRIPTION OF VARIATION AND MATERIAL<br>REVIEW BOARD DISPOSITION | DISCREPANCY: | CONDITION A: THE 1.00 +.0606 DIM. FROM THE T.C.A. CENTERLINE TO THE BOTTOM SURFACE OF THE ELECTRICAL CONNECTOR ON THE OXID. SIDE CHECKS FROM .926 TO .936. REF. ZONE 9 (END VIEW) B/P 208160 - E0153371. | DISPOSITION: | ACCEPTABLE TO USE. |   |    | • |                                       |   |             |                     |             | DNA SERIAL NO. 11058232 | 52-52701-265 PART NO. 208160-61 | PART NAME THRUST CHAMBER, 25 LB., ASSY OF |
|   |              | CONDITION<br>CENTERLINE<br>CONNECTOR<br>REF. ZONE  | DISPO        | ACCEP              | • |    |   | · · · · · · · · · · · · · · · · · · · |   | <del></del> |                     | <del></del> |                         |                                 | IATION LOG                                |
| SERIAL<br>NUMBER  | 1,058232     |  |              |                    |   |    |   | •                                     |   |             |                     |             |                         |                                 | - VARIA                                   |
| PART<br>HUMBER  | 208160-61    |  |              |                    |   |    |   | •                                     |   |             |                     | •           |                         |                                 | END ITEM -                                |
| PART OR COMP. INVOLVED  | TCA          |  |              |                    |   | ٠, |   |                                       | • | •           |                     |             |                         | •                               | 7 DELIVERABLE                             |
| 110<br>% 0,   | MAC MRR      | 075540   |              |                    |   |    |   |                                       |   |             | Table - programme d |             | 501                     |                                 | SE-                                       |

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| 80                                    | 302                   |                               | , AS |                        | 4.4                     |  |
|---------------------------------------|-----------------------|-------------------------------|------|------------------------|-------------------------|--|
| REPLACED BY                           | SERIAL NO.            |                               |      | 4058232<br>208160-61   | B., ASSY OF             |  |
| REPLA                                 | PART NO.              |                               |      | SERIAL NO.<br>PART KO. | THRUST CHAIMER, 25 LB., |  |
|                                       | neason rod kerlacenen | NONE THIS DATE - 15 JULY 1964 |      | DNA<br>52-52701-265    | PART HAME THRUST        |  |
| 92                                    | Similar no.           | NONE                          |      |                        | REPLACEMENT LOG         |  |
| \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ | TAKE SAME             |                               |      |                        | DELLYERADLE END ITER-   |  |
| 0                                     | 1501                  |                               |      |                        | SE-7 DE                 |  |

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|     |   | •        |   |              |              | 5.0             |
|     |   | ,        |   | <b>1.</b> 10 | 4            |                 |
| •   |   |          |   |              | 208160-61    | ASSY OF         |
|     |   | • •      |   |              | 0816         | ASSY            |
|     |   |          |   |              | Ñ            |                 |
|     | • | · ·      |   | · .          | '            | 25 LB.,         |
| •   | • | •        | , |              | PART NO.     |                 |
|     |   | •        | • |              | RT           | TIRUST CHAMBER, |
|     |   | •        |   | •            | PAI          | M               |
|     | : |          |   |              |              | ST              |
|     |   | •        | • |              |              | THE             |
|     |   |          |   |              | 265          | 4               |
| •   |   |          |   |              | . 6          |                 |
|     |   |          |   |              | 52-52701-265 | PART NAME       |
|     |   |          |   |              | 23           | RT              |
|     |   | <b>1</b> |   |              |              | A               |
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| •   |   | SECTION  |   | •            |              | 100             |
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|     |   |          | • |              |              | TEST LOG        |
|     |   | •        | • |              |              | •               |
|     |   | • . •    |   | •            |              | ANC             |
|     | • |          | • |              |              | EPT             |
|     |   |          | • |              |              | ACCEPTANCE      |
|     |   | _        |   |              |              | 1               |
|     | • | •        |   |              |              |                 |
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|     |   | •        |   | •            |              | PONEN           |
|     |   |          |   |              |              | SOLIPONEN       |
| •   |   |          |   |              |              | 7 COLIPONENT    |
|     |   |          |   |              |              | ~               |
|     |   |          |   |              |              | SE- 7 COLIPONEN |
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| PERFORMANCE PARAMETERS                      |                   | PARAGRAPH<br>NUMBER | UNITS               | SPECIFICATION<br>LIMITS | ACCEPTANCE<br>TEST DATA | INSP.      |
|---|-------------------|---------------------|---------------------|-------------------------|-------------------------|------------|
| ELECTRICAL RESISTANCE TESTS                 |                   | 4.2                 |                     |                         |                         |            |
| VALVE DODY TELEDATUME                       |                   | 4.2.4               |                     | •                       | ,                       | 0          |
| 0XIDIZEA                                    | •                 |                     | A STENDER           | 70 H                    | 72                      | ) (        |
| FUEL  |                   |                     | DEGREES F           | 70 - 5                  | 2)                      |            |
| VALVE COIL PESISTANCE                       |                   | 4.2.5               |                     | +                       | 91.01                   | (F         |
| OXIDIZER                                    |                   |                     | Sino                | 1 4                     | 40.400                  | )(         |
| FUEL  | ·                 | •                   | OFFICE              | 42 H                    | 70.820                  | 9          |
| CONTINUITY RESISTANCE                       |                   | 4.2.9               |                     | 1                       | , Ç                     |            |
| OXIDIZEA                                    | •                 |                     | STUTO               | 1.0 EAL.                | 550                     |            |
| FUEL  |                   |                     | OIBUS               | 1.0 EAX.                | 8                       | )          |
| DIELECTRIC STRENGTH TEST                    |                   | 4.3                 |                     |                         |                         |            |
| CURRENT LEAZAGE                             |                   |                     |                     |                         | 7                       | <b>(</b> ) |
| OXIDIZER                                    | •                 | 4.3.8               | MICRO AMPS          | 500 MAX.                | <b>*</b>                |            |
| FÚEL  |                   | 4.3.8               | MICHO AMPS          | 500 MX.                 | *                       | 9          |
| PROOF PRESSURE TEST - TCN FROPELLANT VALVES | VALVES            | 4.4                 |                     |                         | Cararage                |            |
| VALVE FINISUAIZED FOR HINERAL OF            |                   | 4.4.3               | DNA                 | VEGUEY                  | VENTE LEED              | ) (        |
| 3 MINULES AT 500 ± 10 FSIG                  | -                 | •                   |                     | VED 1579                | VERIFIED                |            |
| VALVE DE-FRESSURIZED AND VALVE HOUSING IN   | USING INSPECTED   | 4.4.4               | <b>S</b>            |                         |                         | (          |
| PARAGRAPHS 4.4.3 A:D 44 RZFZATED            | B                 | 4.4.5               | DNA                 | VERITPY                 | VERIFIED                |            |
|   |                   |                     |                     |                         |                         | 4          |
| * N/C AXEND. # 3                            | SPECIFICATION NUI | NUMBER              | DWA<br>52-52701-265 | SERIAL NO.              | 1058232<br>208160-61    |            |
|   |                   | <u>a</u>            | PART NAME THE       | THRUST CHAMBER, 25      | LB., ASSY OF            | 5.1        |
| SE-7 COMPONENT ACCEPTANCE                   | - 1 1             |                     |                     |                         |                         |            |
|   |                   |                     |                     |                         |                         |            |

| PERFORMANCE PARAMETERS   | PARAGRAPH<br>NUMBER                   | UNITS        | SPECIFICATION<br>LIMITS | ACCEPTANCE<br>TEST DATA | INSP.    |
|--|---------------------------------------|--------------|-------------------------|-------------------------|----------|
| PROOF PRESSURE TEST - TCA PROPELLANT VALVES (CONTINUED) CONFORMANCE TO PARAGRAPHS 4.4.3, 4.4.4, AND A A S VERIFIED | (a                                    |              |                         |                         |          |
| OXIDIZER   |                                       | DNA          | Verify                  | VERIFIED                | (P)      |
| FUEL   |                                       | DNA          | Verley                  | VERIFIED                | <b>3</b> |
| PROOF PRESSURE AND LEAKAGE TEST - THRUST CHANDER   | 4.5                                   |              |                         |                         | Œ        |
| CHAMBER PRESSURIZED FOR A MINIMUM OF 5 MINUTES AT 392 \$ 10 PSIG. NO LEAKAGE DETECTED                              | 4.<br>8.                              | DKA          | Ver IFYQ                | VERIFIED                |          |
| CHANDER DE-PRESSURIZED AND PARAGRAPH 4.5.8 REPEATED  | 4.5.8                                 | DKA          | VERITY                  | VERIFIED                | <u> </u> |
| TCA INSPECTED VISUALLY FOR DAMAGE OR DEFORMATION   | 4.5.14                                | DNA          | VERIFY                  | VERIFIED                | <u> </u> |
| FUNCTIONAL TEST - TCA PROPELLANT VALVES  | 4.6                                   |              |                         | •                       |          |
| OPENING RESPONSE TIME  | 4.6.8                                 |              |                         | •                       | از ا     |
| OXIDIZER   | -                                     | SEC.         | .0065 MAX.              | -0042                   | )        |
| FUEL   | · · · · · · · · · · · · · · · · · · · | SEC.         | .0065 MAX.              | 0700.                   | )        |
| CLOSING RESPONSE TIME  | 4.6.10                                |              | ***                     | 7.00                    | £        |
| OXIDIZER   | -, <del>-,-,-</del>                   | SEC.         | . 002 AAA.              | 9100                    | ) (F     |
| FUEL   |                                       | SEC.         | .000 EAA.               | 0                       | 9        |
| CLOSING DROP OUT VOLTAGE   | 4.6.13                                | volt (DC)    | 1 MIN.                  | 1.3                     | ٨        |
| FUEL   |                                       | VOLT (DC)    | 1 MIN.                  | 1.3                     | <b>0</b> |
|  | -<br> -<br> -                         | ANG          |                         | 1,048232                | /        |
| *N/C AMEND. # 3 * RA0220-354   | TION NUMBER -                         | 52-52701-265 | PART NO.                | 203160                  |          |
| SE- 7 COMPONENT ACCEPTANCE TEST  | a.                                    | PART NAME TH | THRUST CHAMBER, 25      | 25., ASSY OF            | 5.1.1    |
|  | •                                     |              |                         |                         |          |

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| PERFORMANCE PARAMETERS  | RS .                 | PARAGRAPH<br>NUMBER | UNITS        | SPECIFICATION<br>LIMITS | ACCEPTANCE<br>TEST DATA | INSP.      |
|---|----------------------|---------------------|--------------|-------------------------|-------------------------|------------|
| LEAKAGE TEST - TCA PROPELLANT VALVES  |                      | 4.8                 |              |                         |                         |            |
| SEAT LEAKAGE RATE   |                      | 4.8.16              | •            |                         |                         | ę          |
| OXIDIZER  |                      | 4.8.17              | SCC/MIN      | 2.21 MAX.               | LESS THAN 0.1           | <u>.</u>   |
| JENA  | •                    | 4.8.17              | SCC/MIN      | 2.21 MAX.               | LESS THAN 0.1           | <u></u>    |
| PRE-TEST DATA   | •                    |                     |              |                         | ,                       | ્રં        |
| DRY WEIGHT  |                      | 4.1.3               | 1.8.         | DNA                     | 3.10                    | )          |
| NOZZIE EXIT DIANETER<br>SECTION A-A   |                      |                     | INCH         | DXA                     | 2.295                   |            |
| THROAT DIALECTER  | •                    |                     | INCH         | DXG                     | .358                    |            |
|   |                      | •                   | INCH         | DNA                     | .358                    | <b>(3)</b> |
| <b>U</b> -0   |                      | •                   | INCH         | DNA                     | .358                    | 3          |
| <b>Q-Q</b>  |                      |                     | INCH         | DNA                     | .358                    | (A)        |
| POST HOT-FIRE DATA  |                      |                     |              |                         |                         | )          |
| PROOF PRESSURE AND LEAKAGE TEST - THRUST CHAIBER                                | UST CHAIBER          | 4.5                 |              |                         |                         | (          |
| CHAMBER PRESSURIZED FOR A MINIMUM OF 5<br>AT 392 ± 10 PSIG. NO I'AMAGE DETECTED | OZ 5 HINUTAS<br>CTED | 4.5,8               | DKA .        | Verify                  | VERIFIED                | <b>3</b>   |
| CHALIDER DE-PRESSURIZED AND ENRAGRAPH 4.  | Pii 4.5.8            | 8.5.8               | DNA          | Verify                  | VERIFIED                |            |
| TCA INSPECTED VISUALLY FOR DALIGY CR DEFORMATION                                | ca deformation       | 4.5.14              | DNA          | VERIFY                  | VERIFIED                |            |
| -   |                      |                     | -            |                         |                         |            |
|   |                      |                     |              |                         |                         | 1          |
|   | SPEC SICATION NI     | NUMBER              | 7/8-1        | SERIAL NO.              |                         | 1          |
| * N/C AMEND. # 3  |                      |                     | 52-52701-265 | PART NO.                | 203160-61               |            |
| SE-7 COMPONENT ACCEPTANCE   | 7. TEST              | A                   | PART NAME TH | THRUST CHAMBER, 25      | LB., ASSY OF            | 5.1.2      |
|   |                      |                     |              |                         |                         |            |

| PERFORMANICE PARAMETERS  DARAGRAPH  UNITS  JOINT LEAKAGE RATE  OXIDIZER  FUZL  SCANTER  LA.17.6  LA.17.6  LA.17.6  SCANTER  LA.17.9  SCANTER  LA.17.9  SCANTER  LA.17.1  LA.17 | • % %       |                 | SPECIFICATION<br>LIMITS | ACCEPTANCE<br>TEST DATA | INSP.          |
|--|-------------|-----------------|-------------------------|-------------------------|----------------|
| LEAK TESTAZIDED JOINTS  JOINT LEAKAGE RATE  OXIDIZER  FUSL  EAKAGE TEST-TCA PROPELIANT VALVES  SZAT LEAKAGE RATE  OXIDIZER  FUEL  CAY WEIGHT  NOZZLE EXIT DIAMETER  SECTION A-A  THROAT DIAMETER  SECTION A-A  B-B  C-C  D-D   |             |                 |                         |                         |                |
| JOINT LEAKAGE RATE  OXIDIZER  FUEL  EAKAGE TEST-TCA PROPELLANT VALVES  SEAT LEAKAGE RATE  OXIDIZER  CXIDIZER  FUEL  CXIDIZER  FUEL  CXIDIZER  CXIDIZER  FUEL  CXIDIZER |             | ••              |                         |                         |                |
| DEAKAGE TEST-TCA PROPELLANT VALVES  LEAKAGE TEST-TCA PROPELLANT VALVES  SZAT LEAKAGE RATE  OXIDIZER  FUEL  CAY WEIGHT  ROZZIE EXIT DIAMETER  SECTION A-A  THROAT DIAMETER  SECTION A-A  THROAT DIAMETER  SECTION A-A  D-D  C-C   | <del></del> | · .             |                         |                         |                |
| EAKAGE TEST-TCA PROPELLANT VALVES  SEAT LEAKAGE RATE OXIDIZER OXIDIZER  FUEL  DAY WEIGHT  ROZZLE EXIT DIAMETER SECTION A-A THROAT DIAMETER SECTION A-A B-B C-C D-D   |             |                 | MAX.                    | 2.6 x 10 <sup>-8</sup>  | <u></u>        |
| LEAKAGE TEST-TCA PROPELLANT VALVES  SEAT LEAKAGE RATE  OXIDIZER  OXIDIZER  FUEL  LAY WEIGHT  ROZZIE EXIT DIAMETER  SECTION A-A  THROAT DIAMETER  SECTION A-A  THROAT DIAMETER  C-C  D-D  |             |                 | MX.                     | 1.6 x 10 <sup>-8</sup>  |                |
| CXIDIZER  OXIDIZER  FUEL  EXY WEIGHT  NOZZIE EXIT DIAMETER  SECTION A-A  THROAT DIAMETER  SECTION A-A  THROAT DIAMETER  C-C  C-C  D-D  | 4-17-9      | •<br>           |                         |                         |                |
| CAYDIZER FUEL  LAY WEIGHT  MOZZIE EXIT DIAMETER  SECTION A-A  THROAT DIAMETER  SECTION A-A  B-B  C-C  D-D  | 4.8.16      | <del>- 12</del> |                         | · .                     |                |
| EXY WEIGHT  HOZZIE EXIT DIAMETER  SECTION A-A  THROAT DIAMETER  SECTION A-A  B-B  C-C  D-D   |             | <del></del> -   | 2.21 MAX.               | LESS THAN 0.1           |                |
| DAY WEIGHT  MOZZLE EXIT DIAMETER  SECTION A-A  THROAT DIAMETER  SECTION A-A  B-B  C-C  IN  IN  IN  IN  IN  IN  IN  IN  IN  I   |             | ·               | 2.21 MAX.               | LESS THAN 0.1           | ()             |
| NOZZIE EXIT DIAMETER SECTION A-A THROAT DIAMETER SECTION A-A B-B C-C D-D   |             | •               | . PMG                   | 3.14                    | (3)            |
| SECTION A-A THROAT DIAMETER SECTION A-A B-B C-C D-D  |             |                 |                         |                         | )              |
| THROAT DIAMETER  SECTION A-A  B-B  C-C  D-D  | INCH        |                 | DNA                     | 2.255                   |                |
| SECTION A-A B-B C-C D-D  | 4.18.1      | <b>,</b>        |                         |                         | )              |
| 8-8<br>2-0   | INCH        | •               | DNA                     | .358                    | E)             |
| 0-0  | INCH        |                 | DNA                     | .358                    |                |
| <b>0.0</b>   | INCH        |                 | DNA                     | .358                    | (F)            |
|  | INCH        | ·               | DIA                     | .358                    | Y\$\bar{4}{6}) |
| DRY WEIGHT (DELIVERABLE)   | ····        |                 | DNA                     | 3.09                    | Œ.             |
| SPECIFICATION NUMBER REVISION AMENDMENT DNA  | ANG         | - 6             | ON IVIOS                | 4058232                 | 1              |
| N/C # 3 52-5   | 52-52701-   |                 | PART NO.                | 208160-61               |                |
| SE-7 COMPONENT ACCEPTANCE TEST PART NAME   | PART NAME   | THRUST CHAMBER, |                         | 25 LB., ASSY OF         | 5.1.3          |
|  |             |                 |                         |                         |                |

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| SPECIFICATION<br>LIMITS | RUN<br>TEST DATA                        | RUN<br>TEST DATA | RUN<br>TEST DA  |
| •                       |   | 1                | ,               |
| •                       | •                                       | •                | •               |
| •                       | •                                       | •                | 1               |
| 8                       | 9                                       | •                | ı               |
| 2 HIN.                  | 1                                       | •                | •               |
| .16 MX.                 | •                                       | •                | •               |
|                         |   | ı                | ı               |
| DNA                     | ٩.                                      |                  | \$              |
| DNA                     | 9                                       | •                | 1               |
| DNA                     | •                                       | •                | 1               |
| DYA                     | •                                       | •                |                 |
| DNA                     |   |                  | 1               |
| DNA                     | •                                       | •                | •               |
| ANG                     | •                                       | •                | •               |
|                         |   |                  |                 |
|                         |   |                  |                 |
| TION NUMBER             |   | DNA S            | SERIAL NO.      |
|                         | 52-52701-265                            |                  | PART NO.        |
| DATA                    | PART NAME                               |                  | THRUST CHAMBER, |

R-15019-2

HOT FIRE TEST DATA - TEST SITE

CELL LOCATION

CELL NUMBER

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CHARACTERISTICS

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DATA FINAL TEST DATA

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1-B

15 JUN 64

(52)

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SEC.

PSIA

ENVIRONMENTAL PC

TEST DURATION

TEST DATE

ALIBIENT PRESSURE

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SEC.

TIME OF DATA SLICE-START

AMBIENT TEMPERATURE

TIME OF DATA SLICE-END

OXIDIZER TETERATURE

FUEL TEMPERATURS

OXIDIZER DENSITY

FUEL DENSITY

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25 LB., ASSY OF- 5.2

CONTRACT

1,058232

L 20.

SPECIFICATION NO

\* RA0220-354

(REA) CALIBRATED PERFORMANCE DATA

SE-7

203160-61

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\* N/C AMEND. #

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| 118    | CHARACTERISTICS                | UNITS           | SPECIFICATION<br>LIMITS | RUN<br>TEST DATA | RUN<br>TEST DATA     | RUN<br>TEST DATA | RUN 217<br>FINAL TEST<br>DATA | INSP.             |
|--------|--------------------------------|-----------------|-------------------------|------------------|----------------------|------------------|-------------------------------|-------------------|
|        | HOT FIRE TEST DATA - TEST SITE | 1               | •                       | 1                | 1                    | •                | NFL                           |                   |
|        | OXIDIŽER INIET PRESSURB        | PSIA            | 292 ± 10                |                  | •                    | •                | 288.7                         |                   |
|        | FUEL INLET PRESSURB            | PSIA            | 292 ± 10                | e                | •                    | 1                | 290.6                         |                   |
|        | OXIDIZER FLOWBATE              | LB/SEC.         | DXA                     | •                | •                    | •                | 9970.                         | ( <u>(3)</u>      |
|        | FUEL FLOWRATE                  | LB/SEC.         | DKA                     | •                | •                    | •                | .0358                         | (£,1)             |
|        | TIMUST                         | LB.             | DXA                     |                  | •                    | •                | 23.8                          | <b>(E)</b>        |
|        | MIXTURE RATIO                  | 9/F             | DVA.                    |                  | •                    |                  | 1.30                          | ng Ti             |
|        | SPECIFIC IMPULSE               | SEC.            | DNA                     | ,                | •                    | 1                | 289.                          | <b>3</b> 7        |
|        | INJECTOR END Pc                | PSIA            | DVA                     |                  | •                    | •                | 138.1                         | ( <del>(</del> 3) |
|        | CHARACTERISTIC VELOCITY        | FT/SEC.         | DXA                     | 8                | •                    | •                | 5431.                         |                   |
|        | THROAT DIAMETER                | IN.             | DNA                     |                  | •                    | ,                | .358                          | <b>(3)</b>        |
| -      | FUEL CRIFICE DIALETER          | IN.             | DNA                     | •                | •                    | •                | 01:870                        |                   |
|        | OXIDIZER ORIFICE DIAMETER      | IN.             | PNG                     | •                | <b>1</b>             | 9                | .03800                        | (3)               |
|        | TCA FIRING TIME (NOTAL)        | SEC.            | TO WX.                  | 7                | •                    | ٠,               | 3.0                           | 0                 |
|        | OXIDIZER SAMPLE NUMBER         | •               | •                       | •                | . \$                 | •                | 238                           |                   |
| 11-150 | FUEL SAMPLE NUMBER             | •               | 1                       | •                | -                    | •                | 239                           | <b>(3)</b>        |
| 019-2  | * N/C AMEND. # 3               | SPECIFICATION * | TION NUMBER             | 52-527           |                      | SERIAL NO        | 1,058232                      |                   |
|        | SE-7 (REA) CALIBRATED PER      |                 | - DATAGE                | PART NA          | NAME THRUST CHAMBER, | 25               | LB., ASSY OF                  | 5.2.1             |
|        |                                |                 |                         |                  |                      |                  |                               |                   |

|                    |                                |             |                           | 49      | CONFIDENTIA          |                |                               |              |
|--------------------|--------------------------------|-------------|---------------------------|---------|----------------------|----------------|-------------------------------|--------------|
| R-150              | CHARACTERISTICS                | UNITS       | SPECIFICATION RUN         |         | RUN<br>TEST DATA     | DATA           | RUN 217<br>FINAL TEST<br>DATA | INSP.        |
| 19-2               | HOT FIRE TEST DATA - TEST SITE | •           | •                         | •       | •                    | •              | NTF                           |              |
|                    | ADJUST TO STANDARD CONDITIONS  |             |                           |         |                      |                |                               |              |
|                    | TimusT                         | LB.         | 23 ± 1.2                  | •       | •                    | •              | 24.1                          |              |
|                    | MIXTURE RATIO                  | 0/F         | 1.30 ± .04                | •.      | •                    | •              | 0£•1                          | <b>(</b> E)  |
|                    | SPECIFIC INPUISE               | SEC.        | ANG                       | 1       | •                    | •              | 292•                          | ÷.).         |
|                    | INJECTOR END Pc                | PSIA        | DNA                       | . 8     | •                    | •              | 138.3                         | (E)          |
|                    | CHARACTERISTIC VELOCITY        | FT/SEC.     | DXA                       | •       | •                    |                | 5h29                          | ( <u>(</u> ) |
|                    | ADJUST TO RATED CONDITIONS     |             |                           |         |                      |                |                               |              |
|                    | Tirust                         | rs.         | 23                        | •       | •                    | •              | 23.0                          | (£2)         |
|                    | MIXTURE RATIO                  | . 0/F       | 1.3                       | 1       | •                    | •              | 1.30                          |              |
|                    | SPECIFIC IMPULSE               | SEC.        | MIN.                      | 1       | •                    | •              | 292                           | (1)          |
| Trapid is the comm |                                |             |                           |         |                      |                |                               | ·            |
|                    |                                |             |                           |         |                      |                |                               |              |
| 1- <del></del>     |                                |             |                           |         |                      |                |                               |              |
| *                  |                                |             |                           |         |                      |                |                               |              |
| ···                |                                |             |                           |         |                      |                |                               |              |
| 119                | AMEND. #                       | SPECIFICA   | SPECIFICATION NUMBER      |         | DNA                  | SERIAL NO.     | 4058232                       | 27           |
| )                  | ** N/C AMEND. # 2              | RA0220-354  | RA0220-354 ard RA0220-230 |         | 52-52701-265         | PART NO        | 208160-61                     |              |
| L                  | SE- 7 (REA) CALIBRATED PER     | PERFORMANCE | E-10ATALITIAL PART        | PART NA | NAME TIRUST CIMMBER, | MMBER, 25 LB., | , ASSY OF                     | 5.2.2        |
| <u>ا</u> ا         |                                | 5           |                           |         |                      |                |                               |              |

\(\frac{1}{2}\)

THE FOLLOWING IS INFORMATION RELATIVE TO THE CLEANLINESS LEVEL OF THE PROPELLANT UTILIZED IN THE HOT-FIRE ACCEPTANCE TEST OF THE THRUST CHAMBER ASSEMBLY.

THE INFLUENT PARTICULATE COUNT OF THE PROPELLANT WAS:

|                    | ACTUAL COUNT | NTO - OXID | DNA     | 92      | 11      | ~        | 0         | 0 | 0        | 0      | 0      |  |
|--------------------|--------------|------------|---------|---------|---------|----------|-----------|---|----------|--------|--------|--|
|                    | ACTUAL COUNT | MMH - FUEL | DNA     | 63      | 7       | 2        | -         | 0 | 0        | 0      | 0      |  |
|                    | LIMITS       |            | *       | 100     | 50      | <b>V</b> |           | 0 | <b>O</b> | 0      | O      |  |
| TO THE TARREST THE |              |            | 21<br>V | 10 - 25 | 25 - 50 |          | 100 - 300 |   | 7 1000   |        | . 0000 |  |
| THE THEFT PART THE | •            |            |         |         |         |          |           |   |          | FIBERS | FIBERS |  |

REFEREE TEST IN BORDERLINE CASES. THE MAXIMUM ALLOWABLE WEIGHT OF CONTAMINANTS SHALL NOT TO BE COUNTED BUT NO SLURRY OF FINE PARTICLES WITCH COVERS MORE THAN AN ESTIMATED S PERCENT OF THE TOTAL EFFECTIVE FILTER AREA SHALL BE ALLOWED." AT THE DISCRETION OF QUALITY ASSURANCE, A WEIGHT DETERMINATION OF TOTAL CONTAMINATION MAY BE MADE AS A BE 0.001 CRAM (1 MG) \* NOTE:

CLASS 14

INSP.

|                                 | 5.3                                       |
|---------------------------------|---|
| 208160-61                       | , ASSY OF                                 |
| NO.                             | 25 LB.                                    |
| PART NO.                        | IAMBER,                                   |
| <br>52-52701-265                | PART NAME THRUST CHAMBER, 25 LB., ASSY OF |
| Amendment<br># 1                |   |
| REVISION<br>B                   | - CONTAMINATION                           |
| SPECIFICATION NUMBER RAC615-003 | SE-7 INFORMATION - CONTAMINAT             |

A Callege

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scd 52-52701-265 s/n 4057532

"CERTIFICATION IS HEREBY GIVEN THAT THE DELIVERABLE END ITEM COVERED BY THIS LOG BOOK WAS MANUFACTURED. INSPECTED AND TESTED IN ACCORDANCE WITH PRESCRIBED DRAWINGS, SPECIFICATION AND QUALITY ASSURANCE PROVISIONS. INSPECTION AND TEST RECORDS ARE ON FILE VERIFYING COMPLIANCE WITH APPLICABLE DRAWINGS AND SPECIFICATIONS, EXCEPT AS NOTED HEREIN"

|                              | 7 NOOB 907                       | LOG BOOK ACCEPTANCE DAT#9 (DRD #9)  | 49)   |
|------------------------------|----------------------------------|-------------------------------------|---|
| SPACE ENGINES<br>ENGINEERING | SPACE ENGINES<br>QUALITY CONTROL | MCDONNELL<br>QUALITY REPRESENTATIVE | GOV'T INSPECTION AGENCT<br>QUALITY REPRESENTATIVE |
| DATE 9/11/64                 | W. 2 / 1/64                      | O.M. Michaelis                      | Christia Alliabrica.                              |

### CONTENTS SECTION I - DELIVERABLE END ITEM ASSEMBLY LOG

SPECIFICS

LOG BOOK

RECORDS CONTAINED IN THIS SECTION ARE PERTINENT TO THE DELIVERABLE END ITEM ACCEPTANCE AND ALSO INCLUDE MODEL CONFIGURATION DATA, PERTINENT DETAILS OF SHORT SHIPMENTS, COMPONENT VARIATIONS, AGE SENSITIVE PARTS RECORD, WEIGHT AND SERIALIZATION RECORDS.

### SECTION IL - ACCEPTANCE TEST LOG

RECORDS OF ASSEMBLY ACCEPTANCE TESTS ARE PRESENTED IN THIS SECTION WITH PERFORMANCE DATA AND SUMMARY DATA ON INSPECTIONS AND ACCEPTANCE.

### GENERAL INFORMATION

THIS LOG BOOK IS PROVIDED FOR SERVICE USE IN RECORDING PERTINENT HISTORICAL DATA AND ALL CHANGES FROM THE ORIGINAL CONFIGURATION. IT IS REQUESTED THIS LOG BOOK ACCOMPANY THE DELIVERABLE END ITEM WHEN TRANSFERRED BETWEEN ROCKETDYNE AND USING AGENCIES.

GROUP-4
Downgraded at 3 year intervals;
declassified after 12 years
EXCECETED VIVES

A DIVISION OF HORTH AMERICAN AVIATION, INC.

SE 7 DELIVERABLE END ITEM - LOG BOOK IDENTIFICATION

0.7

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L.B., ASSY

3

PART NAME THRUST CHAMBER,

उ 9 ROCKETDYNE 1,057532 SEP 5252 THE CHIEF 091805 LIPS INFORMATION AFFECTING
THE PRINTED STATES
TO THE FSPICHAGE LAWS.
OUS 793 AND 774. ITS TRANS.
TATION OF ITS CONTINTS IN LOG BOOK DATE GEN ORDER NO. CONTRACT NO. DWG CHG LTR SERIAL NO. SPEC NO. TEM PART NO. THE NATIONAL DEFINE OF WITHIN THE MEANING OF THE BUS.C., SICTIOUS MISSION OR THE REVELLING ANY MANINER TO AN UT THIS MATERIAL CONTAIN SCD52-52701-265 PROMISITED BY LAW. 52-52701-265 X20161R MCDONNELL

#### DELIVERABLE END ITEM

IN INK OR TYPED FOR PERMANENT RECORD. ENTRIES SUCH AS SERIALIZATION, WEIGHT, APPLICABLE THIS LOG BOOK CONTAINS INFORMATION PERTINENT TO THE DELIVERABLE END ITEM AS SPECIFIED HEREIN BY SERIAL NUMBER AND PART NUMBER. IT IS NECESSARY THAT ALL ENTRIES BE WRITTEN MCR'S, ACCEPTANCE TEST DATA AND CALIBRATION DATA WILL BE ENTERED BY ROCKETDYNE AT THE TIME OF DELIVERY.

RETURNED TO ROCKETDYNE FOR REPAIR, MODIFICATION OR RETEST. ROCKETDYNE WILL THEN ENTER IT IS REQUESTED THAT THIS LOG BOOK ACCOMPANY THIS DELIVERABLE END ITEM IF THE ITEM IS REPAIR, MODIFICATION AND RETEST DATA IN THIS LOG BOOK. THE FORMAT OF PACES IN THIS LOG BOOK SHALL NOT BE REVISED WITHOUT OBTAINING APPROVAL OF ROCKETDINE SPACE ENGINES QUALITY CONTROL

52-52701-265

THRUST CHAMBER, 25 LE., ASSY

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208160 -61

PART NO.

PART NAME

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| SECTION I  22-52704-265 PART NO. 2001GG-61  SE-7 BODULE / COMPONENT ASSEMBLY LOG. PART NAME TRRUST CHAMER, 25 151. ASSY OF 4.0 | At the contract of   |  | -        |                | Į  |
|--|--|--|----------|----------------|----|
| SECTION I  SE-52701-265 PART N  SE-7 HODULE / COMPONENT ASSEMBLY LOG.  PART NAME THRUST CHANGER.                               |  |  |          | .0             | ν. |
| SECTION I  SE-52701-265 PART N  SE-7 HODULE / COMPONENT ASSEMBLY LOG.  PART NAME THRUST CHANGER.                               |  | •  |          | s lb., assy of |    |
| SECTION I  SE-7 MODULE / COMPONENT ASSEMBLY LOG. PART NAME.  |  | · ••   | PART NO. | CIMMER, 2      |    |
| SECTION I  |  | •  | -265     | 1 11           |    |
| SE-7 MODULE / COMPONENT ASSEMBLY   |  |  | 52-5270] | PART NAM       |    |
| R-17019-2  | SECTION I  |  |          | ASSE           |    |
|  | CST2 with the Complete of the control of the Complete of the control of the contr | $R{=}15010{=}2$ for the second contract of the collection of the second contract of the s |          |                |    |

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|-----------------------------|---|---------------------------------|------------------------|
| INSP.                       |   |                                 | 4.1                    |
| AGE CONTROL<br>DATE OF MFG. | 2064  | NO. 4057532<br>NO. 203160-61    | R, 25 LB., ASSY OF     |
| SERIAL NO.                  | 1060472<br>1060471<br>8503029<br>7060491<br>14057735  | DNA SERIAL<br>52-52701-265 PART | IME THRUST CHAMBER,    |
| PART NAME                   | THRUST CHALEER, ASSY OF BODY, THRUST CHALEER, ASSY OF INJECTOR, THRUST CHALEER, ASSY OF VALVE, OXIDIZER, T/C, ASSY OF VALVE, FUEL, T/C, ASSY OF | DNA                             | LIZATION LOG PART NAME |
| REV.<br>LTR.                | DIA<br>DIA<br>DIA   |                                 | & SERIALIZATI          |
| PART NUMBER                 | 203160-61<br>203163<br>203530-11<br>407559<br>407560  |                                 | SE- 7 CONFIGURATION    |
| 25.00<br>0.00               | -4 en en en en en en en en en en en en en   | 125                             | SI                     |

AVE

| MCR / ECP NO. | DATE      | TITLE  | DATE                 | INSP        |
|---------------|-----------|--|----------------------|-------------|
| SE6-062       | 6 JAN 64  | COMPONENT CLEANING; PROVISION FOR  | 11. SEP 64.          | <b>3</b>    |
| 190-93S       | 30 JUL 63 | TCA, ACCEPTANCE TESTS; REVISION OF   | ग इस ल               |             |
| SE6-139       | 15 APR 64 | PLACEMENT OF HAYNES STELLITE #3 SAND CAST ON APPROVED MATERIAL LIST          | 11 SEP 64            | (E)         |
| SE5-144       | 15 AFR 64 | TCA INJECTORS; REDESIGN OF   | नु सा ।              | <b>(3</b> ) |
| SEĆ-179       | 16 JUN 64 | TUBE STUBS; MARKING OF   | म इस ल               |             |
| SEĆ-080       | 28 DEC 63 | THRUST CHAMBER ASSEMBLIES, FABRICATION MATERIAL; APPROVAL OF                 | 17 SEE 64            |             |
| SE7-25        | 9 APR 63  | 25 LB., TCA, MOUNTING HOLES; RELOCATION OF                                   | 13 SEEP 64           | (1)         |
| SE7-29        | 31 MAY 63 | THRUST CHAMBER ASSY., 25; CHANGES TO   | 13 222 (1            | (3)         |
| SE6-085       | 30 JUL 63 | CUSTOMER TEST SURVEILLANCE; REQUIREMENT FOR                                  | 12 SEP 64            | 9           |
| SE6-227       | 6 may 64  | 25 LB., TCA SCD'S CHANGES TO   | म ब्रह्म क           | <b></b>     |
| SE5-233       | 18 AUG 64 | electrical connector "o" rings; replacement of                               | मु स्क्र प           | •           |
|               |           |  |                      |             |
|               |           | DNA SERIAL NO. 52-52701-265 PART HO.   | 4057532<br>208160-61 |             |
| SE-7 DE       | LIVERABLE | SE-7 DELIVERABLE END ITEM-MGR VERIFICATION PART NAME THRUST CHAMBER, 25 LB., | 3., ASSY OF          | 4.2         |
|               |           |  | ,                    |             |

R-15019-2

Security Control

|   | INSP.                                       | (3)  |                         |                      | E <                            |
|---|---|--|-------------------------|----------------------|--------------------------------|
|   | OF VARIATION AND MATERIAL COARD DISPOSITION | THERE ARE VARIOUS NICKS AND SCRATCHES ON THE SHELL ASSEMBLY, THE MOST OUTSTANDING ONE IS LOCATED UNDER THE NUT PLATE AT 12:00 USING THE WEID LINE FROM INJECTOR TO FLANGE AS A REFERENCE. DRILL MARK IS .O11 DEEP AND .025 x .030 OVERALL. |                         | SERIAL NO. 1/05/7532 | THRUST CHAMER, 25 LB., ASSY OF |
|   | BRIEF DESCAIPTION O                         | DISCREPANCT: THERE ARE VARIOUS NI SHELL ASSEMBLY, THE LOCATED UNDER THE NU THE WEID LINE FROM I A REFERENCE. DRILL .025 x .030 OVERALL.  | DISPOSITION: USE AS IS. | DNA<br>52-52701-265  | PART NAME                      |
|   | SERIAL                                      | 4057532  |                         |                      | - VARIATION LOG                |
| • | PART<br>NUMBER                              | 208160-61  |                         |                      | END ITEM -                     |
|   | PART OR COMP.                               | 25 IB. THRUST<br>CHANBER ASST.   |                         |                      | 7 DELIVERABLE                  |
|   | Z Z Z                                       | \$15019-2  |                         | 127                  | SP                             |

| 8.<br>80<br>8.                |                                | 32                     | 4.4                  |
|-------------------------------|--------------------------------|------------------------|----------------------|
| REPLACED DY<br>NO. SERIAL NO. |                                | 4057532<br>208160-61   | LB., ASSY OF         |
| REPLA<br>PART NO.             |                                | SERIAL MO.<br>Part Mo. | CHAMBER, 25          |
| REASON FOR REPLACEMENT        | None this date - ( 11 sept 64) | DNA<br>52-52701-265    | PART NAME THRUST     |
| SERIAL NO. REAS               | T SNOW                         |                        | REPLACEMENT LOG      |
| PART WALE                     |                                |                        | DELIVERABLE END ITEM |
| PART NO.                      |                                |                        | SE-7 DE              |

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203160-61 ASSY OZ THRUST CHAMMER, 25 LB., PART NO. 52-52701-265 PART NAME SE- 7 COMPONENT ACCEPTANCE TEST LOG 129

5.0

| 13        | PERFORMANCE PARAMETERS                           | Paragraph<br>Number                     | UNITS            | SPECIFICATION<br>LIMITS | ACCEPTANCE<br>TEST DATA               | INSP.      |
|-----------|--|---|------------------|-------------------------|---------------------------------------|------------|
| 0         | ELECTRICAL RESISTANCE TESTSTCA PROPELLANT VALVES | ट-१                                     |                  |                         |                                       |            |
|           | BODY TEMPERATURE                                 |   |                  |                         | ,                                     | (£         |
| - COMMENT | OXIDIZER   | 4.2.h                                   | DEGREES F        | 5 : 02                  | 69                                    | <b>(3)</b> |
|           | FUEL   | 4.2.11                                  | DEGREES F        | 20 - 52                 | 69                                    | (%)<br>(%) |
|           | COIL RESISTANCE                                  |   | •                | •                       |                                       | (2)        |
|           | OXIDIZER   | 4.2.5                                   | OHMS             | 12 - 2                  | 80°T1                                 | <b>(3)</b> |
| - T       | FUEL   | 4.2.11                                  | OFMS             | 1,2 - 2                 | <b>p.r</b>                            | <b>P</b>   |
| unat f re | CONTINUITY RESISTANCE                            |   |                  |                         |                                       | (NA        |
|           | OXIDIZER   | 4.2.9                                   | OHAS             | 1.0 MX.                 | 8                                     | <u></u>    |
|           | TEAL   | 4.2.11                                  | OFFIS            | 1.0 MAX.                | 8.                                    |            |
|           | DIELECTRIC STRENGTH TESTPROPELLANT VALVES        | 4.3                                     |                  |                         | •                                     |            |
| -         | CURRENT LEAKLOR                                  |   |                  |                         | •                                     | (Z         |
|           | OXIDIZER   | 4.3.8                                   | MCROAMPS         | 500 MAX.                | ಇ                                     | 3          |
|           | FUEL   | 1.3.11                                  | MICROAMPS        | 500 MIX.                | <b>ಸ</b>                              |            |
|           | PROCF PRESSURE TEST TCA PROPELLANT VALVES        | 7-7                                     |                  |                         | •                                     |            |
|           | VALVES PRESSURIZED FOR NOT LESS THAN 3 MINUTES   |   | •.               | •                       |                                       |            |
|           | OXIDIZER   | •                                       |                  | •                       |                                       | (Za        |
|           | STRP I   | 4.4.3                                   | PSIO             |                         | VERIFIED                              | <b>)</b> ( |
|           | STEP II  | 7.4.4                                   | PSIO             | 500 - 10                | VERIFIED                              |            |
| ]         |  |   |                  |                         |                                       |            |
| 1-15      |  |   | -                |                         | 1.067639                              |            |
| 501       | SPECIFICATION NUMBER AMENDMENT                   |   | DNA              | SERIAL NO.              |                                       |            |
| 9-2       | RA0220-354 NG NG                                 | 1                                       | 52-52701-265     | PART NO.                | 208160                                |            |
|           | SE-7 COMPONENT ACCEPTANCE TEST                   | PA                                      | PART NAME THRUST | CHAMBER, 25             | LB., ASSY OF                          | 5.1        |
|           |  |   |                  |                         |                                       |            |
| •         |  | *************************************** |                  |                         | · · · · · · · · · · · · · · · · · · · | •          |

| Acquerque                              |  |                     |                | ·   |                         |            |
|--|--|---------------------|----------------|---|-------------------------|------------|
| •                                      | PERFORMANCE PARAMETERS   | PARAGRAPH<br>NUMBER | UNITS          | SPECIFICATION<br>LIMITS                     | ACCEPTANCE<br>TEST DATA | -NSP.      |
| R-150                                  | PROOF PRESSURE TEST TCA PROPELLANT VALVES (CONTINUED)  |                     | •              |   |                         |            |
| 19-2                                   | FUEL   |                     | ·              | φ.<br>• • • • • • • • • • • • • • • • • • • | VERTETA                 | X.U        |
| ·                                      | TI GELS .  | 1.h.h               | PSIO :         | . +1  | VERIFIED                |            |
|  | INSPECTED VISUALLY FOR DAMAGE OR DEFORMATION   | •                   |                |   | •                       |            |
| *** ********************************** | OXIDIZER   |                     |                |   | •                       | (Z)        |
|  | STEP I   | 7.7.7               | DNA            | NONE ALLOWED                                | NONE DETECTED           | 3          |
| a,, eta-                               | STEP II  | 4.4.5               | DYA            | NONE ALLOWED                                | NONE DETECTED           | Pog.       |
|  | FUEL   |                     |                |   |                         | (No        |
| ، من - بالآليه                         | . STEP I   | 1.4.4               | DNA            | NONE ALLOWED                                | NONE DETECTED           | <b>(3)</b> |
| r Ma skust                             | STEP II  | 1.4.4               | DNA            | NONE ALLOWED                                | NONE DETECTED           |            |
|  | PROOF PRESSURE AND LEAKAGE TEST THRUST CHAMBER   | 1.5                 | •              |   |                         |            |
| •                                      | PROOF PRESSURE TEST  | .•.                 | •              |   |                         |            |
|  | THRUST CHAMBER PRESSURIZED FOR NOT LESS THAN 5 MINUTES AT  |                     |                | ·   |                         | (A         |
|  | STEP I   | 4.5.8               | PSIO           | 392 ± 10                                    | VERIFIED .              | (3) (2)    |
|  | STEP II  | 1.5.10              | PSIO           | 392 ± 10                                    | VERIFIED                |            |
|  |  | •                   | . •            |   |                         |            |
|  |  |                     |                | •   |                         |            |
|  |  |                     |                |   | ٠                       |            |
|  |  |                     | DNA            | SERIAL NO.                                  | 4057532                 |            |
| 131                                    | SPECIFICATION NUMBER REVISION REPRESSION REP | · ·                 | 52-52701-265   | PART NO.                                    | 208160-51               | -53        |
|  | SE- 7 COMPONENT ACCEPTANCE TEST  | PAI                 | PART NAME THRI | THRUST CHAMBER, 25                          | 25 LB., ASSY OF         | 5.1.7      |
|  |  |                     |                |   |                         |            |

|                         | والمناوات المراجع والمناوي                                |                     | •  | •<br>•                               | Total Secretary N. S.C.        |             | •                     | 5          |                                       | <b>ande</b> al   | 173 <b>2-114</b> |   | <br>                |              | <del>رو م</del>                | j |
|-------------------------|---|---------------------|--|--------------------------------------|--------------------------------|-------------|-----------------------|------------|---------------------------------------|------------------|------------------|---|---------------------|--------------|--------------------------------|---|
| INSP.                   | ·   | (A) (2              |  |                                      | £3)(2                          |             | Æ.5)(                 | <b>(3)</b> | (A)                                   |                  | )                |   |                     | 19-          | 5.1.2                          | 4 |
| ACCEPTANCE<br>TEST DATA |   |                     | NONE DETECTED<br>NONE DETECTED                       |                                      | मृ <b>ट</b> ००•                | .0031       | 2000-                 | 77.00°     | \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ | 1 7              |                  |   | 4057532             | 208160 –61   | LB., ASSY OF                   | • |
| SPECIFICATION<br>LIMITS |   | NONE ALLOWED        | NONE ALLOWED   | ٠.                                   | 0.0065 MAX.                    | 0.0065 MAX. | 0.002 MAX.            | 0.002 MAX. |                                       | I MIN.           | ·                |   | SERIAL NO.          | PART NO.     | THRUST CHAMBER, 25             |   |
| UNITS                   | •   | ANG                 | <b>A</b> NG  | -                                    | SEC.                           | SEC.        | • 385.                | SEC.       |                                       | VOLT (DC)        |                  | • | DNA                 | 52-52701-265 | PART NAME THE                  |   |
| PARAGRAPH<br>NUMBER     |   | 4.5.8               | 4.5.10<br>4.5.14                                     | 9.4                                  | 1:9:1                          | 1.6.8       | 1.6.17                | 4.6.10     |                                       | 4.6.17<br>1.6.13 |                  |   |                     | •            | ă                              |   |
| PERFORMANCE PARAMETERS  | PROOF PRESSURE AND LEAKAGE TESTTHRUST CHAMBER (CONTINUED) | LEAKAGE TEST STEP I | STEP II INSPECTED VISUALLY FOR DAMAGE OR DEFORMATION | FUNCTIONAL TESTTCA PROPELLANT VALVES | OPENING RESPONSE TIME OXIDIZER | FUEL        | CLOSING RESPONSE TIME | FUEL       | CLOSING DROP OUT VOLTAGE              | OXIDIZES         |                  |   | AMENDMENT AMENDMENT | •            | SE-7 COMPONENT ACCEPTANCE TEST |   |

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|                         |   |   |   |   |  |  |  | _  |  |  | •   |                        |                        |  | •   |                           | •  | •  | ı  | _  |
|-------------------------|---|---|---|---|--|--|--|--|--|--|---|------------------------|------------------------|--|---|---------------------------|--|--|--|--|
| INSP.                   |   | (ANG.)  |   | ) (   | <b>F</b>   | (  |  | (Z.  | <b>(3)</b>   |  |   |                        | NC 4:3 gas.            | <del>*************************************</del>   |   |                           | (L)  | (X-45)<br>(R-05)                               |  | 5.1.3  |
| ACCEPTANCE<br>TEST DATA |   | LESS THAN 0.1   | LESS THAN 0.1   |   | 3.20   |  | 2.243  | •  | .358   | .358   | .358  | .358                   |                        |  | 3.22  |                           | 392  | 390  | 4057532<br>208160 <b>-</b> 61                  | LB., ASSY OF   |
| SPECIFICATION<br>LIMITS |   | 2.21 MAX.   | 2.21 MAX.   |   | DNA  | •  | DNA  |  | DNA  | DNA  | ANG   | DNA                    | ٠                      | •  | DNA   | ••                        | 392 ± 10                                       | 392 ± 10                                       | SERIAL NO.                                     | CHAMBER, 25  |
| UNITS                   |   | SCC/MIN .   | SCC/MIN   | ·•  | 1.8.   |  | INCH   |  | INCH   | INCH   | INCH  | INCH                   |                        | ·  | E1  |                           | PSIG   | PSIG   | DNA<br>2-52701-265                             | N NAME THRUST  |
| PARAGRAPH<br>NUMBER     | 8-17                                      | 4.8.17  | 4.8.22  |   | 4.1.3  |  | •  |  |  |  |   |                        |                        | A.   | 4.17.1  |                           | 4.17.4   | 4.71.4   | 181  | PART   |
| RS                      |   | •   |   |   | SURES)   |  | ŗ  |  | •  |  |   | •                      |                        | . •  | IVE COVERS &  | R NOT LESS THAN           |  |  | AMENDMENT #3                                   | E TEST   |
| ANCE PARAMETE           | ILLANT VALVES                             | OXIDIZER  | FUEL  |   | NG PROTECTIVE CLC  | DIMETER  | SECTION A-A  | TER  | SECTION A-A  | B.B.   | 9   | D-D                    |                        | :  | EXCLUDING PROTECT.  | ar pressurized Fo         | STEP I   | STEP II  | REVISION<br>M/C                                | IENT ACCEPTANCE                                      |
| PERFORM                 | LEAKAGE TESTTCA PROPE<br>SEAT LEAKAGE     |   |   | PRE-TEST DATA   | DRY WEIGHT (EXCLUDI  | NOZZIB EXIT  |  | THROAT DIAME.  |  |  |   | •                      | POST HOT-FIRE DATA     | PROOF PRESSURB TEST  | DRY WEIGHT (E   | THRUST CHAMBE 5 MINUTES . |  |  | Specification number.<br>Rao220-354            | SE-7 COMPONENT                                       |
|                         | SPECIFICATION ACCEPTANCE LIMITS TEST DATA | PARAGRAPH UNITS SPECIFICATION ACCEPTANCE NUMBER LIMITS TEST DATA  VALVES  4.8 | IETERS PARAGRAPH UNITS SPECIFICATION ACCEPTANCE LIMITS TEST DATA 14.8 | IETERS PARAGRAPH UNITS SPECIFICATION ACCEPTANCE LIMITS TEST DATA 14.8  14.8.17 SCC/MIN 2.21 MAX. IESS THAN 0.1  14.8.22 SCC/MIN 2.21 MAX. IESS THAN 0.1 | PERFORMANCE PARAMETERS  NUMBER  UNITS  LIMITS  LIMITS  TEST DATA  1.8  AT LEAKAGE RATE  OXIDIZER  OXIDIZER  U.8.17  SCC/MIN  2.21 MAX. LESS THAN 0.1  LUMBER  UNITS  LUMITS  LESS THAN 0.1 | PERFORMANCE PARAMETERS  PARAGRAPH  UNITS  LIMITS  LIMITS  LIMITS  LIMITS  LIMITS  TEST DATA  Lichtoformance Parameters  Lichtofor | PERFORMANCE PARAMETERS  PARAGRAPH  UNITS  LIMITS  TEST DATA  L.8  AT LEAKAGE RATE  OXIDIZER  OXIDIZER  OXIDIZER  T. (EXCLUDING PROTECTIVE CLOSURES)  L.1.3  LB.  DNA  3.20 | PERFORMANCE PARAMETERS  PARAGRAPH  UNITS  LIMITS  LIMITS  TEST DATA  LIMITS  LIMITS  LIMITS  LIMITS  LIMITS  LIMITS  LIMITS  TEST DATA  LIMITS | PERFORMANCE PARAMETERS  PARAGRAPH  UNITS  LIMITS  LIMITS  LIMITS  LIMITS  TEST DATA  AT LEAKAGE RATE  OXIDIZER  OXIDIZER  TOCA PROPELLANT VALVES  AT LEAKAGE RATE  OXIDIZER  OXIDIZER  PUBL  PUB | PERFORMANCE PARAMETERS  PARAGRAPH  UNITS  LIMITS  LIMITS  TEST DATA  L.8.17  SCC/HIN  Z.21 MAX. LESS THAN 0.1  L.8.27  T (EXCLUDING PROTECTIVE CLOSURES)  T (EXCLUDING PROTECTIVE CLOSURES)  T (EXCLUDING PROTECTIVE CLOSURES)  L.1.3  L.1.3  LB.  DNA  Z.2L3  DNA  Z.2L3  DNA  Z.2L3  SECTION A-A  INCH  DNA  Z.2L3 | PERFORMANCE PARAMETERS         PARAGRAPH NUMBER         UNITS         SPECIFICATION ALMES         ACCEPTANCE           -TCA PROPELLANT VALVES         4.8         4.8         1.8 | PERFORMANCE PARAMETERS | PERFORMANCE PARAMETERS | PARAGRAPH         UNITS         SPECIFICATION         ACCEPTANCE           PROPELLANT VALVES         4.8         1.8         1.8         1.8         1.6 | PARAGEAPH         UNITS         SPECIFICATION         ACCEPTANCE           PROPELLANT VALVES         4.8         1.8.17         TEST DATA           PROPELLANT VALVES         4.8         1.8.17         SCC/HIN         2.21 MAX.         IEST DATA           SAKAGE BATE         4.8.22         SCC/HIN         2.21 MAX.         IESS THAN 0.1           PUBL         1.8.22         SCC/HIN         2.21 MAX.         IESS THAN 0.1           CLUDING PROTECTIVE CLOSURES)         1.1.3         IB.         DNA         3.20           EXIT DILMETER         SECTION A.A         INCH         DNA         2.243           DILMETER         SECTION A.A         INCH         DNA         3.56           B-B         INCH         DNA         3.358           C-C         INCH         DNA         3.358           C-C         INCH         DNA         3.358           INCH         DNA         3.358           C-C         INCH         DNA         3.358           C-C         D.D         INCH         DNA         3.358 | PROPELLANT VALVES         | PARAGRAPH   UNITS   SPECIFICATION   ACCEPTANCE | PARAGEAPH   UNITS   SPECIFICATION   ACCEPTANCE | PARAGRAPH   UNITS   SPECIFICATION   ACCEPTANCE | NUMBER   NUMBER   NUMIS   SPECIFICATION   ACCEPTANCE |

|   | <u> </u>                | •                              | ens company  | :: ```                            | , ·   | الترويس الرويس الدوسي الدوسي الدوسي الدوسي الدوسي الدوسي الدوسي الدوسي الدوسي الدوسي الدوسي الدوسي الدوسي الد | *   | ·          | · · ·                           | <u>عام</u> ر      |
|---|-------------------------|--------------------------------|--|-----------------------------------|---|---|---|------------|---------------------------------|-------------------|
|   | INSP.                   | . (48)                         | (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)                            |                                   |   |   | (B) (B).  |            | 1 1 -                           | 12:1              |
|   | ACCEPTANCE<br>TEST DATA | NONE DETECTED                  | NONE DETECTED<br>NONE DETECTED                                     | •                                 | VERIFIED  | 3.8x10 <sup>-8</sup>  | LESS THAN 0.1<br>LESS THAN 0.1                                  | •          | 7                               | 25 LB., ASSY OF   |
| l | SPECIFICATION<br>LIMITS | NONE ALLOWED                   | NONE ALLOWED<br>NONE ALLOWED                                       |                                   | 500 ± 10<br>500 ± 10                                      | 10 <sup>-6</sup> MX.<br>10 <sup>-6</sup> MX.  | 2.21 MAX.<br>2.21 MAX.  |            | <b>4</b> 1                      | CHAMBER,          |
|   | UNITS                   | YXC                            | ANG  | •                                 | PSIO<br>PSIO  | 203/203<br>203/203  | 28/208<br>28/208  |            | DNA<br>52-52701-265             | PART NAME THRUST  |
|   | PARAGRAPH<br>NUMBER     | 1,-17.h                        | 4.17.4<br>4.17.4   |                                   | 4.17.5  | 4.17.6  | 4.17.9<br>4.17.9  |            | , .                             | 8                 |
|   |                         |                                | ION  | 2                                 | <b>S</b>  | •   |   |            | AMENDMENT #3                    |                   |
|   | PERFORMANCE PARAMETERS  | (OEII)                         | STEP II<br>STEP II<br>INSPECTED VISUALLY FOR DAMAGE OR DEFORMATION | Tron Styco o improve              | INLET TUBE PRESSURIZED WITH WASEOUS MELLEN. OXIDIZER FUEL | OXIDIZER<br>FUEL  | CANT VALVES OXIDIZER FUEL                                       | •          | REVISION                        | T ACCEPTANCE TEST |
|   | PERFORMANCE             | POST HOT-FIRE DATA (CONTINUED) | INSPECTED VISUALLY F   | LEAK TEST WELDED JOINTS LEAK TEST | INLET TUBE PRESSURLY                                      | JOINT LEAKAGE RATE  | LEAKAGE TEST TCA PROPELLANT VALVES SEAT LEAKAGE RATE OXIDI FUEL | R- 15019-2 | SPECIFICATION NUMBER RA0220-354 | SE-7 COMPONENT    |

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| R-150 | PERFORMANCE  | PARAMETERS  |              | PARAGRAPH<br>NUMBER | UNITS                                | SPECIFICATION<br>LIMITS         | ACCEPTANCE<br>TEST DATA                | INSP.                             |
| 19-2  | NOZZIE EXIT DIAMETER  SECTION A-A  THROAT DIAMETER (DELIVERED CONDI  SECTION A-A  B-B  C-C  D-D  DRY MEIGHT IN DELIVERED CONDITION  (EXCLUDING PROTECTIVE COVERS AND CLOSUR! | NOZZIE EXIT DIAMETER SECTION A-A SECTION A-A SECTION A-A B-B C-C D-D IT IN DELIVERED CONDITION NO PROTECTIVE COVERS AND CLOSURES) | (Xo.         | h.18.1              | INCH<br>INCH<br>INCH<br>INCH<br>INCH | DNA<br>DNA<br>DNA<br>DNA<br>DNA | 2.24.7<br>.358<br>.358<br>.358<br>.358 | <b>&amp; &amp;&amp;&amp;&amp;</b> |
| 135   | SPECIFICATION NUMBER RA0220-354  | REVISION  | AMENDIENT #3 |                     | DNA<br>52-52701-265                  | SERIAL NO.                      | 4057532<br>2081.6061                   | 1                                 |
|       | SE-7 COMPONENT   | ACCEPTANCE TEST   | ST           | PAI                 | PART NAME THRUST                     | CHAMBER, 25                     | LB., ASSY OF                           | 5.1.5                             |

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| CHARACTERISTICS | UNITS                    | SPECIFICATION<br>LIMITS | RUN 193<br>TEST DATA | RUN ******<br>TEST DATA | RUN******<br>TEST DATA | RUN 196<br>FINAL TEST<br>DATA | INSP.              |
|-----------------|--------------------------|-------------------------|----------------------|-------------------------|------------------------|-------------------------------|--------------------|
| SITE            | •                        |                         | NPL                  | •                       |                        | NFL                           |                    |
|                 | •                        | ŧ                       | 1-C                  |                         | •                      | 1-c                           |                    |
|                 | 9.                       | ı.                      | 379                  | •                       |                        | 379                           |                    |
|                 | •                        |                         | 11 Aug 1964          | •                       | •                      | 13 Aug 1964                   | (E)                |
|                 | SEC.                     | 2 HIN.                  | 3.0                  |                         | •                      | 3.0                           | ( <del>3.</del> k) |
|                 | MSM                      | .16 EAX.                | .05020               | •                       | •                      | .07240                        | <b>E</b>           |
|                 | PSIA                     | אים                     | 12,23                |                         | •                      | 12.16                         | <b>3</b>           |
|                 | ďo                       | DitA .                  | 84.0                 | •                       |                        | 80.08                         |                    |
|                 | sec.                     | DUA                     | 2.8                  |                         | 1                      | 2.8                           | (***)              |
|                 | 'oas                     | DNA                     | 2.8                  | •                       | •                      | 2.8                           |                    |
|                 | o <sub>F</sub>           | אזע                     | 77.8                 |                         | •                      | 65.5                          |                    |
|                 | <b>do</b> ∵              | סינע                    | 77.5                 | •                       |                        | 67.0                          | <b>(3)</b>         |
|                 | LB/FT <sup>3</sup>       | DKA                     | 90.87                | . •                     | •                      | 91.20                         |                    |
|                 | LB/FT <sup>3</sup>       | DXA                     | 54.37                | 8                       | •                      | 54.85                         | <b></b>            |
|                 |                          |                         |                      |                         |                        |                               |                    |
|                 |                          |                         |                      |                         |                        |                               |                    |
|                 | SPECIFICATION BA0220-354 | FICATION NUMBER         |                      | 01-265                  | SERIAL NO              | 4057532<br>208160-61          |                    |
| J ~ l           | PERFORMANCE              | DATA                    | PART NA              | NAME THRUST             | THRUST CHAIBER, 25     | LB., ASSY OF                  | 5.2                |
| 1               |                          |                         | •                    | ,                       |                        |                               | 1                  |

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THE CATIONAL DEFENSE OF THE U D STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, WITHIN THE MEANING OF THE ESPIONAGE LAWS, TILLE IS U.S.C., SECTIONS 733 AND 7.2, TIS TRANSMISSION OF THE REVLATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS EXCHANGED AND TANDER TO AN UNAUTHORIZED PERSON IS

| Downgraded at 3 year intervals declassified after 12 years |               |                         | ここし                  | ANY N                  | LANNEZ TO AN  | UNAUTHORIZED PERSON           | S NO.         |
|--|---------------|-------------------------|----------------------|------------------------|---------------|-------------------------------|---------------|
| CHARACTERISTICS  | STIND         | SPECIFICATION<br>LIMITS | RUN 193<br>TEST DATA | RUN *****<br>TEST DATA | ATA           | RUN 198<br>FINAL TEST<br>DATA | INSP          |
| A B A C B C C C C C C C C C C C C C C C                    | •             |                         | . NFT.               | •                      | 1             | NFT.                          |               |
| HOT FIRE TEST LAIN TEST OF                                 | DOTA          | 292 ± 10                | 201.0                |                        | 1             | 9,162                         |               |
| OXIDIZEN INLET PRESSOUS                                    |               | +                       | 2000                 |                        | •             | 201.5                         | •             |
| FUEL INLET PRESSURE  | PSIA          | •                       | 1.102                |                        | ٠             | 70-7-                         | (A.A.)        |
| OXIDIZER FLOERATE  | LE/SEC.       | DNA                     | -04747               | •                      | •             | •0l473                        | 3             |
| FUEL PLOWMATE  | LB/SEC.       | DXA                     | •03396               | •                      | •             | 03/123                        |               |
| Tour   | 1.3.          | DNA                     | 23.4                 | •                      | •             | 22.6                          | િસ્           |
| LIXTURE RATIO  | · 0/F         | DNA                     | 1,40                 | •                      | 1             | 1.3                           |               |
| SPECIFIC HEWISE  | SEC.          | DNA                     | 288.                 | •                      | •             | 287.                          | 3)            |
| INJECTICA END PC   | PSIA          | DNA                     | 136.3                |                        | •             | 131.9                         | <b>3</b> ) (§ |
| CHARACTERISTIC VELOCITY                                    | FT/SBC.       | DNA                     | 5423.                | •                      | •             | 5110                          |               |
| THEORY DIABETED  | Įn.           | DNA                     | .358                 | •                      | •             | ,358                          | 3) (          |
| FUEL CAIPICE DIAMETA                                       | .NI           | DNA .                   | 04.958               | •                      | ٠             | 01,820                        | <b>(3)</b>    |
| OXIDIZER CHIPICE DIMETER                                   | D.            | DNA                     | •03987               | ı                      | •             | 03785                         |               |
| TCA FIRING TIEB (TOCAL)                                    | • DES         | 10 MAX.                 | 3.0                  |                        | •             | 0°9                           |               |
| OXIDIZER SAMPIE NUTTER                                     | •             | a -ti                   | 278.                 | •                      |               | 281.                          |               |
| FUEL SAMPLE NUTERER  | •             | •                       | 279•                 |                        | •             | 279.                          |               |
|  | SPECIFICATION | ATION NUMBER            |                      |                        | NO.           | 2027532                       |               |
| REV. NONE AMEND. 13  | RA022         | RA0220-354              | 52-52701-265         |                        | င္ခဲ ြ        | TO AGE OF                     | 5.2,1         |
| SE-7 (REA) CAUBRATED PEF                                   | PER FORM AND  |                         | Bull Land            | THRUST                 | CHAMBER, 25 L |                               | ;             |
|  |               |                         |                      |                        |               |                               |               |

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5.2.2 INSP. 3 (E) Fig. (F. 8) MISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS MATIONAL DEFENSE OF THE UNITED STATES FECTING TITLE 13 U.S.C., SECTIONS 753 AND 754, 115 TRANS-IN THE MEANING OF THE EPPICHAGE LAWS. RUN 196 FINAL TEST THRUST CHAMBER, 25 LB., ASSY OF DATA 203160-61 MATERIAL CONTAINS INFORMATIO 4057532 131.5 23.0 5407. 22.8 1.30 1.30 290. 290. K TEST DATA RUN \*\*\*\*\* SERIAL NO. PART NO. MALY AND TEN BY LAW DATA \*\*\*\*\* TEST 52-52701-265 ı ı R N N NAME DNA Downgraded at 3 year intervals: DATA PART eclassified after 12 years 193 136.2 5416. 23.6 1,30 1.36 23.0 290. 289 KE TEST SPECIFICATION RUN PERFORMANCE 6ATA + interval **GROUP 4** \*SPECIFICATION\*\*NUMBER RA0220-354 and RA0220-230 ŝ MIN. + 1.2 LIMITS 1.30 ± 1.3 DIG MA NA 23 ŧ 272 23 UNITS FT/SEC. PSIÁ SEC. SEC. 20 8 Ë EB. • (REA) CALIBRATED ALLUST TO STANDARD CONDITIONS HOT PIRE TEST DATA - TEST SITE CHARACTERISTIC VELOCITY ALLIUST TO RATED CONDITICUS CHARACTERISTICS AMEND. #3 SPECIFIC IMPUISE SPECIFIC IMPUISE INJECTOR END Pe MIXTURE RATIO MIXTURE RATIO \* REV. NONE \*\* REV. NONE TRUST THEUST

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| THE FOLICAING IS INFORMATION RELATIVE TO THE CLEANLINESS LEVEL OF THE PROPELLANT UTILIZED |  |
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| PROPELLAN   |  |
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| p   | •  |
| LEVEL   | THE HOM-FIRE ACCEPTANCE TEST OF THE THRUST CHAMBER ASSEMBLY. |
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THE INFLUENT PARTICULATE COUNT OF THE PROPELLANT WAS:

| ACTUAL COUNT | CIXO - OXID | DNA    | 15      |   | 0  | 1  | 0          | 0 | 0      | 0      |
|--------------|-------------|--------|---------|---|----|----|------------|---|--------|--------|
| ACTUAL COUNT | MAH - FUEL  | DKA    | 55      | 6 |    | 0  | 0          | 0 | 0      | 0      |
| LDGTS        |             | *      | 100     | & | ın | e4 | •          | • | 0      | 0      |
|              |             | g<br>V | 10 - 25 |   |    | •  | 300 - 1000 |   |        |        |
|              |             |        |         |   |    |    |            |   | FIBERS | FIBERS |

<sup>&</sup>quot; NOT TO BE COUNTED BUT NO SLURRY OF FINE PARTICLES WHICH COVERS MORE THAN AN ESTIMATED 5 PERCENT OF THE TOTAL EFFECTIVE FILTER AREA SHALL BE ALLOWED." AT THE DISCRETION OF QUALITY ASSURANCE, A WEIGHT DETERMINATION OF TOTAL CONTAMINATION MAY BE MADE AS A REFEREE TEST IN BOHDERLINE CASES. THE MAXIMUM ALLOWABLE WEIGHT OF CONTAMINANTS SHALL BE 0.001 GRAM (1 MG) NOTE:

CLASS

| T NO. 208160-61 ~ | 52-5270-265 PART | AMENDMENT<br>#2 | REVISION B - CONTAMINATION | SPECIFICATION NUMBER RAC615-003 SE-7 INFORMATION |  | REVISION AMENDMENT | B #2 52-5270-265 PART NO. | SE-7 INFORMATION - CONTAMINATION PART NAME THRUST CHAMBER 25 LB., ASSY OF 5.3 |
|-------------------|------------------|-----------------|----------------------------|--|--|--------------------|---------------------------|---|
|-------------------|------------------|-----------------|----------------------------|--|--|--------------------|---------------------------|---|



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#### APPENDIX D

DESIGN APPROVAL TEST SPECIFICATION AND DATA



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THRUST CHAMBER ASSEMBLY - 25#

McDonnell Part Number - 52-52701-265 Rocketdyne Part Number- 208160-61 Test Number - 208160-401

#### ROCKETDYNE

A DIVISION OF NORTH AMERICAN AVIATION, INC.

#### PREPARED BY

E. Adams

APPROVED BY

R. W. Helsel

Gr. Proj. Engr. REVISIONS

DATE 3 August 1964

| DATE       | REV. BY | PAGES AFFECTED! | REMARKS                              |
|------------|---------|-----------------|--------------------------------------|
| 31 Aug 64  | P4      | 50, 376         | Deleted Injector Plate Accelerometer |
| 21 Aug 64  | RC      | 30              | Changed Figure 12                    |
| 29 Sept 64 | JG      | 36 & 37         | Revised Procedure of para 6.7        |
| 29 Sept 64 | JG      | 379             | Revised Figure 10                    |
| 21 Oct 64  | RC      | 39,70 871       | Revised Procedure of para 6.8        |
| 21 Oct 64  | RC      | 40.1            | Added page                           |
| 15 Oct 64  | EA      | 13,1            | /d'od page                           |
| 28 Oct 64  | JG      | 358, 359        | Revised Table I                      |

R-1:019-2

NO. OF PAGES

380°

, 4,3

DESIGN APPROVAL TESTS OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANUEVER SYSTEM ( SE7 ) THRUST CHAMBER ASSEMBLY -25# 20 352-McDonnell Part Number - 52-52701-265 Rocketdyne Part Number- 208160-61 Test Number - 208160-401 89. 3.56 12-Charenes This drawing is during fraight approved swith (without) changes. Such apparent does not relieve Seller warranty (PRECIMINARY) (FINAL) APPROVAL A. C. purchase order conditions. DWG: CONT. as provided in M. R-15019-2 144

#### ROCKETDYNE A DIVISION OF NORTH AMERICAN AVIATION, INC.

| DATE      | REV BY   | PAGES AFFECTED   | REMARKS  |
|-----------|--|--|--|
| 11 Sep 64 | RC   | 55   | Changed X to Z                                 |
|           |  |  |  |
| 6 Oct 64  | . EA   | 334  | Changed paragraph number                       |
| 28 Oct 64 | JG   | 373  | Revised Figure 6                               |
| 20 Nov 64 | FA ·   | 380  | Revised Figure 11                              |
| 1 Dec 64  | RC   | 330  | Revised procedure of Para.7.2.5                |
| 1 Dec 64  | RC   | 330.1 &331.1   | Added pages                                    |
| 1 Dec 64  | RC .   | 356  | Revised para. 7.3.4                            |
| 1 Dec 64  | RC   | 356.1 & 357 <b>.1</b>  | Added Pages                                    |
| 1 Dec 64  | JG   | 359.1  | Added Page                                     |
| 3 Dec 64, | RC   | 41.1, 41.2 &   | Changed Page Nos.                              |
| 3 Dec 64  | RC   | 15   | Added Ex. Atmos & Fuel Test Ox.Resist.<br>Test |
| 3 Dec 64  | RC   | 89.01, 89.02,<br>89.03, 89.04,                                 | Added Page Numbers                             |
|           |  | 89.05, 89.06,<br>89.07, 89.08                                  |  |
|           |  | 89.09, 89.1,   |  |
|           |  | 89.11, 89.12,<br>89.13,89.14,                                  |  |
|           |  | 89.13,89.14,<br>89.15, 89.16,<br>89.17, 89.18,<br>89.19, 89.2, |  |
|           |  | 89.19, 89.2  |  |
|           | The train of the later of the l | 89,21, 89,22,<br>89,23 & 89,24                                 |  |
| 3 Dec 64  | RC   | 380.1, 380.2<br>& 380,3  | Added Figures 12, 13 & 14                      |
| 22 Dec 64 | RC   | 111  | Added Data Sheet                               |
| 77 D-c.   | . <i>7</i> %   | 84.5.8.9   |  |
|           |  |  | •  |
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| R-15019-2 |  |  | 145  |

THRUST CHAMBER ASSEMBLY - 25#

McDonnell Part Number 52-52701-265

Rocketdyne Part Number 208160-61

Test Number

208160-401

#### DESCRIPTION OF COMPONENT

The OAMS Thrust Chamber Assembly consists of an ablation cooled thrust chamber with a silicon carbide throat insert and expansion nozzle, an injector, two fast acting solenoid valves for propellant flow control, orifices for fixing the component pressure drop, associated interconnecting plumbing and mounting provisions for attaching the assembly to the spacecraft structure.

## EROCKETDYNE A DIVISION OF NORTH AMERICAN AVIATION, INC.

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|---|---|
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| 1.0   | SCOPE   |
| 2.0<br>2.1<br>2.2<br>2.3<br>2.4   | APPLICABLE DCCUMENTS  McDonnell Aircraft Specifications  Military Specifications  Rocketdyne Specifications  Rocketdyne Drawings  |
| 3.0<br>3.1<br>3.2<br>3.3<br>3.4<br>3.5<br>3.6<br>3.7<br>3.8<br>3.9<br>3.10<br>3.11<br>3.12<br>3.13<br>3.14<br>4.0 | GENERAL REQUIREMENTS  Safety Handling Photographic Coverage Instrument Calibration Maintenance Failures Test Witnessing Cleanliness Requirements Report Component Test Modification Sampling.and Analysis Post Test Hardware Disposition Abbreviations Definations TEST HROGRAM   |
| 4.1<br>5.0<br>5.1<br>5.2<br>5.3<br>5.4<br>5.5<br>5.6<br>5.7   | EQUIPMENT AND MATERIALS  Material  Special Equipment  Standard Pneumatic and Hydraulic Equipment  Standard Electrical Equipment  Standard Leakage Testing Equipment  Miscellaneous Equipment  Special Equipment   |
| 6.0<br>6.1<br>6.2<br>6.3<br>6.4<br>6.5<br>6.6<br>6.7<br>6.8<br>6.9<br>6.10  | OPERATIONAL TESTS AND PROCEDURES  Propellant Valve Proof Pressure and Leakage Thrust Chamber Proof Pressure and Leakage Propellant Valve Electrical Resistance Propellant Valve Dielectric Strength Propellant Valve Functional Weight Determination Thrust Chamber Assembly Firing Procedure Decontamination Procedure Propellant Valve Orifice Removal Propellant Valve Load Analysis |
| 7.0<br>7.1<br>7.2<br>7.3  | ENVIRONMENT AND SERVICE LIFE TESTS  Thrust Chamber Assembly Number One Thrust Chamber Assembly Number Two Thrust Chamber Assembly Number Three  |

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| IV             |          | TCA Design Approval Test Duty Cycle Direct Inking Graphic Recording Schedule - TCA Design Approval Test Duty Cycle |            |

### FIGURES

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| 1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7.<br>8.<br>9.<br>10.<br>11.<br>12. |      | Schematic<br>Schematic<br>Graph<br>Schematic<br>Drawing<br>Graph<br>Graph<br>Trace<br>Schematic<br>Schematic | - Propellant Valve E1 - Propellant Valve Pr - Thrust Chamber Prod - Propellant Valve Fo - Propellant Valve Vo - TCA Hot Fire Propel - Vibration and Shock - Random Vibration - Propellant Valve Re - Thrust Pulse Parame - Sectioning Diagram: - Fuel and Oxidizer R - Explosive Atmospher - Propellant Valve Lo | roof Pressure of Pressure ar unctional oltage and Cur llant Feed Systems to the control of the c | and Leakage<br>nd Leakage<br>rrent Traces<br>stem |
|   |      |  |  |  |   |

| COMPONENT | NAME THRUST | CHAMBER | ASSEMBLY | - 25# | DADT   | NO. { MAC 52-52701-265   208160-61 |                        | 5        |
|-----------|-------------|---------|----------|-------|--------|------------------------------------|------------------------|----------|
| TEST NO.  | 208160      |         |          |       | — PARI | NAA                                | 208160-61<br>- SHEET 1 | OF 380   |
|           |             |         |          |       |        |                                    |                        | <u> </u> |

Reference:

MAC SCD 52-52701- Rev. F

1.0

SCOPE

This specification establishes the method of test and the test equipment required to conduct the Design Approval Tests of Three Thrust Chamber Assemblies for the McDonnell Aircraft Corporation Model 133P, Orbit Attitude and Maneuver System as specified in McDonnell Aircraft Corporation Specification Control Drawing 52-52701, Rev. F, paragraph 6.3.1.3.2.

PREPARED BY: Let DATE APPROVED FOR NAA: DATE APPROVED FOR McDONNELL DATE

CHECKED BY: DATE

1/911/10/64

FORM 608-B-40 NEW 6-63

| COMPONENT NAMI | E THRUST CHAMBER AS   | SEMBLY - 25# PART NO {MAC 52-52701-265 208160-61  |  |  |  |  |
|----------------|---|---|--|--|--|--|
| TEST NO.       | 208160-401  | NAA 200100-01 SHEET 2 OF 380  |  |  |  |  |
| Poternana (a)  | WAG COD EQ CODOS D  |   |  |  |  |  |
|                | MAC SCD 52-52701, Rev   | rision F  |  |  |  |  |
| 2.0            | APPLICABLE DOCUMENTS  |   |  |  |  |  |
|                | The documents listed in this specification are for reference only except those marked with an asterisk (*). If the requirements of this specification differ from those listed below, the requirements of this specification shall govern, except in the case of SCD52-52701 which is the contractual controlling document. |   |  |  |  |  |
| 2.1            | McDonnell Aircraft Sp   | pecifications   |  |  |  |  |
|                | SCD 52-52701  | Specification Control Drawing, MAC Model 133P, Orbit Attitude and Manuever System Rev. F, dated 9 August 1963. (CONFIDENTIAL                            |  |  |  |  |
|                | *Report #8392   | Standard Engineering Responsibilities Technical Data Requirements and Product Support Recommendations, Model 133P SCD Equipment, dated 22 June 1962.    |  |  |  |  |
|                | Report #8518  | General Electrical Design Requirements<br>for Electrical Equipment and Equipment<br>Utilizing Electrical Power for MAC Model<br>133P, dated 1 May 1962. |  |  |  |  |
| 2,2            | Military Specification  | ons.  |  |  |  |  |
|                | HIL-E-5272C-1   | Environmental Testing, Aero and Associated Equipment, General Specification for, dated 20 January 1960.   |  |  |  |  |
|                |   | •   |  |  |  |  |
| CHECKED BY:    | DATE APPROVED FOR NA DATE - 4/1/4 6-63  | A: DATE APPROVED FOR MCDONNELL DATE   |  |  |  |  |

### ROCKETDYNE

# DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

|  |   | ·   |
|--|---|---|
| COMPONENT NA   | • .                                       | MBLY - 25# PART NO {MAC 52-52701-265 208160-61  |
| TEST NO.   | 208160-401                                | SHEET 3 OF 380  |
| 2.2<br>(cont'd)  | MIL-L-25567                               | Leak Test Compound, Oxygen System, dated 7 January 1959   |
|  | MIL-P-26539A                              | Propellant, Nitrogen Tetroxide, dated 31 July 1961  |
|  | MIL-P-27401A                              | Propellant, Nitrogen Pressurizing, dated 7 November 1960  |
|  | MIL-P-27404                               | Propellant, Monomethyl Hydrazine, dated 3 April 1962  |
|  | MIL-A-6091B                               | Alcohol; Ethyl, Specially denatured, dated 12 January 1962  |
|  | Federal Stock No. 6830-263-9842           | Helium  |
| 2.3  | Rocketdyne Specification                  | ons.  |
|  | *RA0112-002                               | Lubricants, Anti-Seize Compounds and<br>Gasketing Type Seal Compounds for Rocket<br>Engines, dated 29 July 1963 |
|  | *RAO 220-290                              | SE6 and SE7 Propulsion System Component Weight Determination, dated 2 October 1963                              |
|  | RAO 220-230                               | SE7 208160 Assembly Data Reduction and Adjustments, dated 15 July 1963 (CONFIDENTIAL)                           |
|  | *RAO 220-354                              | Gemini SE7 Thrust Chamber Assembly<br>Acceptance Test Procedure, dated 6<br>January 1964                        |
| E. Adams  CHECKED BY:  The control of the control o | DATE S/28/64 APPROVED FOR NAA DATE LY-3 G | DATE APPROVED FOR MCDONNELL DATE  |

R-15019-2

FORM 608-B-40 NEW 6-63

| COMPONENT NA    | ME THRUST CHAMBER | ASSEMBLY - 25# PART NO. \ MAC \ \ 20316C-61   |
|-----------------|-------------------|---|
| TEST NO.        | 208160-401        | NAA 203180-61 SHEET 4 OF 380  |
| 2.3<br>(cont'd) | *RA0201-050       | Acceptance Test Instrumentation Requirements, dated 9 August 1961                                 |
|                 | *RA0607_009       | In Place Erazing of Tubes and Fittings<br>for Space Engines, dated 30 December 1963               |
|                 | *RA0610-002       | Ultrasonic Cleaning of Space Engine<br>Hardware, dated 20 June 1963                               |
|                 | *RA0610-003       | Cleaning Space Engine Hardware by Liquid Flushing, dated 24 October 1963                          |
|                 | *RA0610-009       | Chemical Cleaning of Filter Elements<br>for Space Engines, dated 22 April 1964                    |
|                 | *PEN 25.01G       | Environmentally Controlled Areas,<br>Definitions and Specifications for, dated<br>2 December 1963 |
|                 | *RA0616-005       | SE7 Propulsion System Inter and Intra<br>Plant Handling, dated 20 March 1963                      |
| •••             | *SEN 4388-4040    | Pulse Performance Data Reduction Procedure dated 22 July 1964.                                    |
|                 | * RA0616- 008     | SE7 Propulsion System: Preparation for Customer Delivery, dated 4 September 1963                  |
|                 | SEM 3391-3009     | Operation Manual SE6 and SE7 Electrical Control System, dated 28 August 1963.                     |

| 1 |                 |               |                   |        |                        |      |
|---|-----------------|---------------|-------------------|--------|------------------------|------|
|   | PREPARED BY:    | DATE          | APPROVED FOR NAA: | DATE   | APPROVED FOR MCDONNELL | DATE |
|   | E. Adams        | 7-20-64       | DH 5-0.           | _      |                        |      |
| þ | - Lander        | DATE . S. Cay | Sta Eid           | 9-1-01 |                        |      |
| Ī | FORM 608-B-40 N | IEW 6-63      | <u> </u>          |        |                        |      |

| COMPONENT NAM | E THRUST CHAMBER ASSA | EBLY - 25# PART NO { MAC 52-52701-265   208160-61                   |
|---------------|-----------------------|---|
| TEST NO.      | 200100-401            | SHEET_5_ OF_3   |
| 2.4           | Rocketdyne Drawings   |   |
|               | Drawing 208160 (-61)  | Thrust Chamber, 25 lbs, 45 Min, Assy of, dated 26 September 1963    |
|               | Drawing T5034515      | Pressure Test and Water Flow Fixture, dated 19 July 1963            |
|               | Drawing 99-106126     | Adapter - Fitting, Assy of, dated 22 October 1963                   |
|               | Drawing 99-106713     | Thrust Chamber Installation - 25# OAMS, dated 17 April 1964         |
|               | Drawing 99-106694     | Tube Assy of, dated 10 April 1964                                   |
|               | Drawing 99-106695     | Tube, Assy of, dated 10 April 1964                                  |
|               | Drawing               | Shipping Container, SE7 25# TCA with Extended Inlet Adapters, dated |
| •             | Drawing 99-106728     | Propellant Valve Orifice Adapter, dated                             |

PREPARED BY: E. Adams

()

DATE

APPROVED FOR NAA:

23 September 1964

APPROVED FOR MCDONNELL

7-20-64 The Menus. 8-3-62 CHECKED BY:

FORM 608-B-40 NEW 6-63

| COMPONENT                         | NAME-        | THRUST CHAMBER ASSEMBLY - 25# PART NO. {MAC-  | 52 <b>-</b> 52701 <b>-</b> 26 <b>5</b><br>208160 <b>-</b> 61 |  |  |  |
|-----------------------------------|--------------|---|--|--|--|--|
| TEST NO                           | <del></del>  | 208160-401 NAA-   | SHEET 6 OF 380   |  |  |  |
| Reference:                        | (a) MAC      | SCD 52-52701, Revision F  |  |  |  |  |
| 3.0                               | GEN          | ERAL REQUIREMENTS   |  |  |  |  |
| 3.1                               | Safe         | <b>∍ty</b>  |  |  |  |  |
|                                   | Sual         | safety precautions necessary to comply with th<br>ll be in accordance with Rocketdyne Safety Depa<br>ectives.   | is procedure<br>rtment                                       |  |  |  |
| 3.2                               | Hand         | iling   |  |  |  |  |
|                                   | RAO6<br>test | All inter and intra plant handling and packaging shall be accomplished per the requirements of Rocketdyne Specification RAO616-005 when the TCA is being transported, or stored between tests, except that Components with extended inlet tube stubs installed shall be packaged in container |  |  |  |  |
| 3.3                               | <u>Phot</u>  | cographic Coverage  |  |  |  |  |
|                                   | prel<br>Rock | Photographs shall be taken of each different TCA installation test and shall be included in the final test report. Three preliminary copies of these pictures shall be forwarded to the Rocketdyne Gemini Project Office within 14 days from the exposure date.                               |  |  |  |  |
|                                   | Suff<br>cove | Photographs which will provide visual evidence of a failure shall be taken of the component after any malfunction. Sufficient views shall be taken to provide complete visual coverage of the failure, including photomicrographs when applicable.  |  |  |  |  |
| 3.4                               | Inst         | rumentation (paragraph 6.2.1.2 of reference a   | .)   |  |  |  |
| •                                 | All<br>of t  | test parameters shall be assigned a tolerance the specified value unless otherwise denoted he   | of + 2% .<br>rein.   |  |  |  |
| PREPARED BY: E. Adams CHECKED BY: | tA 5/29      | ATE APPROVED FOR NAA: DATE APPROVED FOR M   | COONNELL DATE  |  |  |  |

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FORM 608-B-10 NEW 6-63

### ROCKETDYNE A DIVISION OF NORTH AMERICAN AVIATION. INC

## DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT NA                        | AME THRUST CHAMBER ASSEMBLY - 25# PART NO { MAC 52-52701-265   208160-61   SHEET 7 OF 380  |
|-------------------------------------|--|
| 3.4<br>(cont'd)                     | All instrumentation employed for monitoring the required test parameters shall be calibrated at frequent intervals to insure attainment of minimum steady-state accuracy of ± 2% of the full scale range of the instrumentation being used, except were instrumentation accuracy is otherwise specified. Calibration records shall be maintained and made available to authorized personnel upon request. Hot fire instrumentation shall be in accordance with specification RAO201-050 and Table I of this specification. |
| 3.5                                 | Maintenance (paragraph 6.2.3 of reference a)   |
|                                     | Servicing, adjustment, or replacement of parts shall not be permitted unless specifically stated in this specification.  Lubrication of fittings is permitted per RAO112-002.  |
| 3.6                                 | Failures (paragraph 2.5.2 of McDonnell report 8392)  |
|                                     | In the event that the component fails to pass any part of the Design Approval Test, immediately discontinue all testing of that component and notify the Rocketdyne Gemini Project Office.   |
|                                     | McDonnell Aircraft Corporation and Rocketdyne shall jointly review the failure and determine the corrective action to be taken and the point in the test procedure where retesting is to begin.  |
| 3.7                                 | Test Witnessing (paragraph 6.2.1.3 of reference a)   |
|                                     | Each Design Approval Test shall be witnessed and the test data certified by Rocketdyne inspection, and certified by the Government Inspection Agency having cognizance at the testing facility. McDonnell and Government Inspectors shall be notified 4 hours in advance of all tests.   |
| PREPARED BY: 9 E. Adams CHECKED BY: | DATE DATE DICOLOR STU-COV  |
| FORM 608-B-40                       |  |

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| COMPONENT | NAME THRUST CHAPBLE ASSEME | BLY - 25# PART NO { MAC 52-52701-265   208160-61 |
|-----------|----------------------------|--|
| TEST NO   | 203160-401                 | NAA SHEET 8 OF 380                               |

3.7 (continued)

MAC Engineering shall be notified 3 days in advance of the schedule date of any Design Approval Test. If MAC Engineering indicates a desire to witness any test, notification shall again be performed 4 hours prior to the beginning of the test. Actual testing shall not commence prior to the arrival of all witnesses unless prior waiver is obtained. Notification of the MAC Resident Engineering Office shall constitute notification of MAC Engineering.

3.8

### Cleanliness Requirements

Hot Fire Test and Decontamination Facilities. During the time that the TCA is being installed in or removed from a hot fire test facility or a decontamination facility, the TCA propellant valve inlets, when open, shall be protected by a plastic enclosure. A low volume nitrogen purge, filtered through two, 10 micron absolute, stainless steel wire mesh filters, installed in series, shall be used to prevent entrace of foreign material into the enclosure.

Other Test Facilities: The propellant valve inlets shall not be directly exposed to an environmental atmosphere which does not meet the requirements of a Class IV area as specified in Rocketdyne Plant Engineering Manual PEM 25.01G. It shall be requirement that a ten (10) micron absolute wire mesh stainless steel filter be installed on the propellant valve inlets in a Class IV area. The entire test setup shall be assembled and disassembled in a Class IV area.

| ŀ |                 |           |                   |      |              |           |      |
|---|-----------------|-----------|-------------------|------|--------------|-----------|------|
| ı | PREPARED BY:    | DATE      | APPROVED FOR NAA: | DATE | APPROVED FOR | McDONNELL | DATE |
| L |                 | 1-20-64   | ONO.              |      |              |           | VAIE |
| . | CHECKED BY:     | DATE 3-64 | \$46ids 8-        | 4-64 |              | ~         |      |
|   | FORM 608-B-40 I |           |                   |      |              |           |      |

| COMPONENT | NAME.       | THRUST CHAMBER | - 25# | DADT | NO SMAC- | 52-52701-2<br>208160-61 | 65          |
|-----------|-------------|----------------|-------|------|----------|-------------------------|-------------|
| COMPONENT | 11/11/11/11 |                |       |      | NAA-     | 203160-01               | <del></del> |
| TEST NO   |             | 208150-401     |       |      |          | SHEET_9_                | OF 280      |

## 3.8 (continued)

Cleaning of Test Setup Hardware:

The ten micron absolute stainless steel wire mesh filters shall be cleaned per Rocketdyne Specification RAC610-CO9 and stored in polyethylene bags until ready for use. Hillipore filter housings shall be cleaned per Rocketdyne Specification RAC610-CO3 prior to installation of the new Millipore filter elements into the housings. The Millipore filter assemblies shall be stored in polyethylene bags until ready for use. The lines which are to be used between the test setup filters and the TCA shall be cleaned per Rocketdyne Specification RAC610-CO2 each time the filters are installed into test setup. Test setup hardware, which is too large for polythylene bags shall be protected by appropriate closures, which have also been cleaned so as not to lower the level of cleanliness of the hardware.

| PREPARED BY: | DATE    | APPROVED FOR NAA: | DATE  | APPROVED FOR | McDONNELL DA |
|--------------|---------|-------------------|-------|--------------|--------------|
| E. Adams     | 7-20-64 | Duc.              |       |              |              |
| CHECKED BY:  | DATE    | 1 Cica            | 8-4-6 |              |              |

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| COMPONENT | NAME THRUST CHAMBER | ASSEMBLY - 25# PART | NO. { MAC 52-52701-265 NAA 208160-61 |
|-----------|---------------------|---------------------|--------------------------------------|
| TEST NO   | 208160-401          |                     | NAA 208160-61 SHEET 10 OF 380        |

- .9 Report
- 3.9.1 Data

Data shall be recorded directly on the applicable data sheets inserted after each test of this specification. All raw data shall be identified relative to the test to which it pertains. That raw data specifically requested by MAC Engineering shall be further identified relative to parameter measured, calibration factors, etc. and shipped to MAC, St. Louis. Reduced data shall include graphical presentations and time histories of all pertinent performance parameters.

3.9.2 Discussion of Data

In the final report all pertinent data obtained in the DAT series shall be analyzed and discussed. Any significant trends leading to pertinent conclusions or recommendation for further testing shall be covered.

3.9.3 Acceptance Test Data

Acceptance test log data shall be retained and be included as part of the final report for this component.

3.10 Component Test Modification

The propellant valve inlets of each TCA shall be modified following Pre-Test Inspection by the addition of an inlet tube adapter. Attachment of the adapter shall be by brazing in accordance with RAO607-009. Failure at the inlet adapter or the braze joint during subsequent testing shall not constitute a failure of the TCA.

| 1 |                  | ····    |                   |        |   |      |
|---|------------------|---------|-------------------|--------|---|------|
|   | PREPARED BY: 4/  | DATE    | APPROVED FOR NAA: | DATE   | APPROVED FOR MEDONNELL  | DATE |
|   | E. Adams         | 6-8-64  | 0. 1              |        |   |      |
|   | CHECKED BY:      | DATE    | Stide             | 8-4-64 |   |      |
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|   | 1 OKM 000-8-40 N | EW 6-63 |                   |        | 2000-20 |      |

| COMPONENT | NAME THRUST CHAMBER | ASSEMBLY - 25# DART | NO { MAC 52-52701-265   208160-61 |
|-----------|---------------------|---------------------|-----------------------------------|
| TEST NO   | 208160-401          | FART                | NAA 208160-61 SHEET 11 OF 380     |
|           |                     |                     | SHEET OF                          |

### 3.11 Sampling and Analysis of Propellants

Samples of propellants shall be obtained for analysis whenever propellants are introduced into the test facility tanks and at least once daily, during the time that LAT hot fire tests are conducted, for the purpose of specific gravity determination.

Semples of propellants shall be obtained for analysis whenever propellants are introduced into the test facility tanks and at least once weekly, during the time that LAT hot fire tests are conducted, for the purpose of propellant composition determination.

The data of the most recent analysis shall be recorded for each hot fire test. However, in the event that propellant tanks are filled between DAT hot fire test subsequent hot fire testing shall be delayed pending the results of the analysis of the new propellant.

### 3.12 <u>Post Test Hardware Disposition</u>

Upon successful completion of the Design Approval Tests, the components shall be cleaned as required for shipment, packaged in accordance with RA0616-008, and shipped directly to MAC, St. Louis. This shall not include components which fail during DAT and for which a failure analysis is required, except that components showing unusual failure modes shall be made available to MAC following Rocketdyne failure analysis.

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### A DIVISION OF NORTH AMERICAN AVIATION. INC

# DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# PART NO. MAC 52-52701-265 |            |
|--|------------|
| 208160-101   |            |
| TEST NO. SHEET OF  | <u>380</u> |
| 3.13 Abbreviations   |            |
| Abs - Absolute   |            |
| AC - Alternating Current   |            |
| cps - Cycles Per Second  |            |
| DAT - Design Approval Tests  |            |
| DC - Direct Current  |            |
| DIGR - Direct Inking Graphic Recorder                                  |            |
| F - Fahrenheit or Thrust   |            |
| g - Standard Gravitational Acceleration                                |            |
| GN <sub>2</sub> - Gaseous Nitrogen                                     |            |
| He - Helium  |            |
| Hr - Hour  |            |
| LVDT - Linear Variable Differential Transformer                        |            |
| MAC - McDonnell Aircraft Corporation                                   |            |
| Min - Minute or Minimum  | •          |
| ml - Milliliter  |            |
| MIP - Minimum Impulse Pulse  |            |
| MMH - Monomethylhydrazine  |            |
| NOM - Nominal  |            |
| NTO - Nitrogen Tetroxide   | •          |
| OAMS - Orbit Attitude and Maneuver System                              |            |
| osc - Oscillograph or Oscilloscope                                     |            |
| P - Pressure   |            |
| psig - Pounds Per Square Inch Gauge                                    | •          |
| psia - Pounds Per Square Inch Absolute                                 |            |
| RMS - Root Mean Square   |            |
| SCC - Standard Cubic Centimeters                                       |            |
|  |            |
| SCD - Specific Control Drawing msec - Milliseconds                     |            |
| Sec - Seconds  |            |
|  |            |
| ,                                | 3 .        |
|  |            |
|  |            |
| U - Upper  |            |
| Faximum Thrust   |            |
| DOCOADCO   | Devis      |
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THRUST CHAMBER ASSEMBLY - 25# PART NO. 52-52701-265 COMPONENT NAME-208160-61 208160-401 TEST NO. SHEET 13 OF 380 3.14 Definitions \*Duration - Total time from "first indication" in starting sequence to 2%-of-maximum thrust point in the shutdown sequence. Impulse, Mean Specific - Total impulse divided by total weight of propellants consumed. Impulse, Specific - The thrust in pounds divided by the propellant consumption rate in pounds per second. Impulse, Total - Area under the thrust-time curve. \*Pulse - A pulse includes all events from the "on signal" to 2-percent-of-maximum thrust point in the shutdown sequence. \*Signal, ON - The signal to open the propellant valves. This is the start of the starting sequence. \*Signal, OFF - The signal to close the propellant valves. This is the start of the shutdown sequence. \*Signal Width - Time from "on signal" to "off signal". \*Time, Start - Time from "on signal" to the 90 percent-of-maximum thrust point in the starting sequence. \*Time, Shutdown - Time from "off signal" to 2 percent-of-maximum thrust point in the shutdown sequence. \*Time, Effective Firing - Time from 90-percent-of-maximum thrust point in the start sequence to the 90-percent-of-maximum thrust point in the shutdown sequence. Lockup Pressure - Pressure immediately upstream of the propellant valve prior to TCA operation.

\* See Figure 10

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#### ROCKETDYNE A DIVISION OF NORTH AMERICAN AVIATION, INC

### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT | NAME THRUST CHAMBER ASSEMBLY - 25# PAR | T NO MAC 52-52701-265<br>208160-61 |
|-----------|--|------------------------------------|
| TEST NO   | 208160-401                             | SHEET 3.1 OF 380                   |

Soakout Period - Time required for slowest TCA skin temperature to stabilize and drop 5°F to verify that 3.14 (cont'd) peak temperature has been reached.

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### ROCKETDYNE

## DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT NA | THRUST CHAMBER ASSIMBLY - 25# PART NO.{MAC  | 52-52701 <b>-</b> 265<br>208160 <b>-</b> 61 |
|--------------|---|---|
| TEST NO.     | 208160-401  | SHEET_14 OF_380                             |
| ILOI NU.     |   | STEET-## UF-29                              |
| Reference:   | MAC SCD 52-52701, Revision F  |   |
| 4.0          | Test Program  |   |
|              | Three (3) Thrust Chamber Assemblies (P/N 208160-having passed the acceptance tests of RA0220-354 be subjected to Design Approval Tests (DAT) in a with the requirements presented in this specific For purposes of identification during the DAT pr the three TCA's shall be designated one (1) through the three (3) respectively. | , shall<br>ccordance<br>ation.<br>ogram,    |
| 4.1          | Test Sequence   |   |
|              | The following paragraphs list the TCA, the Appli<br>Environmental and Service Life Tests for each TC<br>the operational tests and procedures which will<br>used to demonstrate SCD compliance. The tests if<br>each TCA shall be performed in the order listed.   | A and<br>be<br>or                           |
|              |   |   |
|              |   |   |
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PREPARED BY:

E. Adams

DATE APPROVED FOR MCDONNELL

|  | •                                    | munion aux   |  |  | 5  | 2-52701-265  |
|--|--------------------------------------|--|--|--|--|--|
| COMPONENT                                      | NAME-                                | THRUST CHAM  | MBER ASSEMBLY  | - 25# PAR1                                   | NO. SMAC                                 | 08160-61   |
| TEST NO.                                       |                                      | 208160-1,01  | ·.   |  |  | SHEET 15 OF 380  |
| 4.1.1  | Thrust Cl                            | hamber Assem   | ıbly Number C  | ne   |  |  |
|  |                                      |  |  |  | Para.                                    | SCD<br>Page Reference  |
|  |                                      | Inspection Determinat  | ion  | •.   | 7.1.1<br>6.6                             | 6.2.2.1<br>6.3.1.4.1   |
|  | Thrust<br>Propel<br>Propel<br>Propel | llant Valve<br>Chamber Pr<br>Llant Valve<br>Llant Valve<br>Llant Valve | Proof Pressure<br>coof Pressure<br>Electrical R<br>Dielectric S<br>Functional              | & Leakage<br>esistance                       | 7.1.2<br>6.1<br>6.2<br>6.3<br>6.4<br>6.5 | 6.2.3.17.3<br>6.2.3.1<br>6.3.1.1.10<br>6.2.3.2<br>6.2.3.3<br>6.3.1.3.1 |
|  | Propel Propel                        | llant Valve<br>Chamber Pr<br>Llant Valve                               | Proof Pressure<br>coof Pressure<br>Electrical R<br>Dielectric S<br>Functional              | & Leakage esistance                          | 7.1.3<br>6.1<br>6.2<br>6.3<br>6.4<br>6.5 | 6.2.3.16<br>6.2.3.1<br>6.3.1.1.10<br>6.2.3.2<br>6.2.3.3<br>6.3.1.3.1   |
|  | DAT Duty                             | Cycle to Fa  | ilure  |  | 7.1.4                                    | 6.3.1.3.2.2  |
|  | Disassemb                            | oly and Insp   | ection   | •  | 7.1.5                                    | 6.2.3.20.1   |
|  | Propel<br>Propel<br>Propel           | llant Valve  | (Prop Valve<br>Proof Pressu<br>Electrical R<br>Dielectric S<br>Functional                  | re and Leaka<br>esistance                    | 7.1.6<br>6.1<br>6.3<br>6.4<br>6.5        | 6.2.3.13<br>6.2.3.1<br>6.2.3.2<br>6.2.3.3<br>6.3.1.3.1                 |
|  | Propel<br>Propel<br>Propel<br>Propel | llant Valve<br>llant Valve<br>llant Valve<br>llant Valve               | sistance (Pr<br>Electrical R<br>Functional<br>Dielectric S<br>Proof Pressu<br>Load Analysi | esistance<br>trength<br>re & Leak <i>age</i> | 6.3<br>6.5<br>6.4                        | 6.2.3.18<br>6.2.3.2<br>6.3.1.3.1<br>6.2.3.3<br>6.2.3.1<br>6.2.3.26     |
|  | •                                    |  |  |  |  | •  |
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### ROCKETDYNE A DIVISION OF NORTH AMERICAN AVIATION INC

# DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT | NAME THRUST CHAMBER ASSEMBLY - 25#PART N<br>208160-401  | INAA_ZOC                 | -52701-265<br>8160-61<br>EET 16 OF 380                              |
|-----------|---|--------------------------|---|
| 4.1.2     | Thrust Chamber Assembly Number Two  |                          |   |
|           |   | Para. Page               | SCD<br>Reference  |
| ·         | Pre-Test Inspection Weight Determination  |                          | 6.2.2.1<br>6.3.1.4.1  |
|           | Temperature Shock Propellant Valve Proof Pressure & Leakage Thrust Chamber Proof Pressure & Leakage Propellant Valve Flectrical Resistance Propellant Valve Dielectric Strength Propellant Valve Functional | 6.1<br>6.2<br>6.3<br>6.4 | 6.2.3.7<br>6.2.3.1<br>6.3.1.1.10<br>6.2.3.2<br>6.2.3.3<br>6.3.1.3.1 |
|           | Impulse Signal Width  | 7.2.3                    | 6.3.1.3.2.2   |
|           | DAT Duty Cycle to 160 Seconds Weight Determination  |                          | 6.3.1.3.2.2<br>6.3.1.4.1  |
|           | Disassembly and Inspection  | 7.2.5                    | 6.2.3.20.1  |

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| COMPONENT | NAME THRUST CHAMBER ASSEMBLY - 25# PART  | No. MAC - 3  | 2-52701-265<br>08160-61  |
|-----------|--|--------------|--------------------------|
| TEST NO.  | 208160-401                               | NAA          | HEET 17 OF 380           |
| 4.1.1     | Thrust Chamber Assembly Number Three     |              | The Table of the Table   |
|           |  | Para. Page   | SCD<br>Reference         |
|           | Pre-Test Inspection Weight Determination | 7.3.1<br>6.6 | 6.2.2.1<br>6.3.1.4.1     |
|           | DAT Duty Cycle to 118 Seconds            | 7.3.2        | 6.3.1.3.2.2              |
|           | Burst Pressure Weight Determination      | 7.3.3<br>6.6 | 6.3.1.3.2.2<br>6.3.1.4.1 |
|           | Disassembly and Inspection               | 7.3.4        | 6.2.3.20.1               |

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|                                    | NAME THRUST CHAMBER ASSEMBLY - 25# PART NO (MAC 208160-61   |
|------------------------------------|---|
| COMPONENT                          | NAA ZOOTCO-CT   |
| TEST NO                            | 208160-401 SHEET 18 OF 380  |
| Reference:                         | MAC SCD 52-52701, Revision F  |
| 5.0                                | EQUIPMENT AND MATERIAL (Equivalent items may be used)   |
| 5.1                                | <u>Material</u>   |
| 5.1.1                              | Nitrogen Tetroxide - MIL-P-26529A (Oxidizer) (0.3% H <sub>2</sub> 0 Permitted)  |
| 5.1.2                              | Monemethyl Hydrazine - MIL-P-27404A (Fuel)  |
| 5.1.3                              | Nitrogen Gas - MIL-P-27401A   |
| 5.1.4                              | Freon TF - Commercial Grade   |
| 5.1.5                              | Helium - Federal Stock Number 6830-283-9842   |
| 5.1.6                              | Alcohol - MIL-A-6091B (Reagent Grade Isopropyl Alcohol Am. Chem. Soc. Standard is considered equivalent).   |
| 5.1.7                              | Leak Test Compound - MIL-I-25567  |
| 5.1.8                              | Water - Distilled and/or De-ionized (pH: 6.5 to 7.5)  |
| 5.2                                | Special Equipment   |
| 5.2.1                              | Hot Fire Facility   |
|                                    | A facility capable of static firing the TCA's at both ambient conditions and at a simulated pressure altitude of 100,000 feet or greater.                                 |
|                                    | Suitable equipment to provide and utilize hot GN2 purge, Anhydrous Isopromyl Alcohol and Freon TF fluids for decontamination, flushing and cleaning the TCA after firing. |
|                                    | The facility shall be equipped to meet the instrumentation requirements of Table I.   |
|                                    | •   |
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| COMPONENT | NAME THRUST CHAMBER ASSEMBLY - 25# PART NO MAC    | 52-52701-265    |
|-----------|---|-----------------|
| TEST NO.  | 0001/0 101  | SHEET_19 OF 380 |
| 5.2.1     | The facility shall be equipped with a thrust mour | t designed      |

5.2.1 (cont'd)

The facility shall be equipped with a thrust mount designed for thrust vector determination during steady state operation. The facility shall be equipped with a high natural frequency thrust mount for axial thrust determination during DAT duty cycle operation and impulse signal width tests.

The facility shall be equipped with a TCA firing control system consisting of a pulse generator, automatic tape programmer, TCA control panel, TCA power distribution panel and a regulated DC power supply. The TCA installation wiring is shown in MAC SCD 52701, Revision F, Figure 18. The automatic tape programmer shall be capable of controlling the pulse sequence and duration of Table II, and instrumentation recording sequence of Table III, and Table IV.

The facility shall be equipped with a propellant feed system per Figure 6.

5.2.2

#### Vibration Testing Facility

The facility shall be capable of vibrating the TCA at frequencies of 5 to 2000 cps and at the random vibration power spectral density per Figure 8.

The facility shall be equipped with a servo control unit for varying the vibration frequency logarithmically.

The facility shall be equipped with a Ling ASDE 80 equalization console and a Ling power amplifier to control the random vibration input.

The facility shall be equipped with a test fixture to which the TCA can be attached by employing simulated spacecraft brackets and use of its attach points shown in Figure 7. The test fixture

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| TEST |       | ***   | 208160- |         |          |              |        |           | SHEET 20   |     |
|------|-------|-------|---------|---------|----------|--------------|--------|-----------|------------|-----|
| COMP | ONENT | NAME- | THRUST  | CHAMBER | ASSEMBLY | <b>-</b> 25# | - PART | NO. {MAC- | 52-52701-3 | 265 |

5.2.2 (cont'd)

shall be capable of being mounted on the vibration machine such that the TCA can be vibrated along each of the three mutually perpendicular axes shown in Figure 7. Provision shall be made for attaching the extended propellant valve inlet lines to the test fixture.

The facility shall be equipped with accelerometers with an accuracy of ±5% from 5 to 2000 cps, and a natural frequency over 30,000 cps.

The facility shall be equipped with a multichannel oscillograph for recording the accelerometer output during the vibration sweeps.

The facility shall be equipped with a multichannel FM magnetic tape recorder for recording the accelerometer output during the random vibration.

The facility shall be equipped with a Ballantine True RMS Meter to measure the RMS G acceleration.

The facility shall be equipped with a Technical Froducts Company analyzer to analyze the accelerometer output power spectral density shape.

5.2.3 <u>Temperature Chamber (Non-Firing)</u>

An enclosure in which the TCA or the TCA propellant valves can be exposed to air temperatures of -40 to 200F. The temperature chamber shall be capable of maintaining any specified temperature within this range to ±5F. The air temperature shall be continuously recorded. The internal volume shall be sufficient so that all applicable test procedures can be accomplished. Instrumentation shall be provided for continuous recording of chamber temperatures.

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COMPONENT NAME THRUST CHAPBER ASSEMBLY - 25# PART NO. | MAC | 52-52701-265 | 208160-401 | SHEET 21 OF 380

#### 5.2.4 Shock Testing Facility

The facility shall be capable of imparting half sine wave shocks of 15  $\pm$  1.5 g magnitude and 11  $\pm$  1.0 millisecond duration to the TCA.

The facility shall be equipped with a rigid jig test fixture to which the TCA shipping container, as specified in RAO616-008, can be rigidly attached. The rigid jig test fixture shall be capable of being mounted on the shock machine such that the TCA, in its shipping container, can be shocked along the plus and minus direction of each of the three mutually perpendicular axes shown in Figure 7. The facility shall be equipped with an accelerometer.

The facility shall be equipped with an accelerometer (Statham, Model A5TCA-50-350) which shall be mounted on the rigid jig test fixture.

The facility shall be equipped with an oscilloscope (Tektronix, Model 535 or 564) for monitoring the accelerometer output and recorded on a Polaroid camera.

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FORM 608-B-40 NEW 6-63

| COMPONENT     | NAME THRUST CHAMBER ASSEMBLY - 25# PART NO. { MAC 52-52701-265 208160-61 SHEET 22 OF 380   |
|---------------|--|
|               |  |
| 5 <b>.2.5</b> | Electronic Cycler  |
|               | A device which can be used to cycle the propellant valves at cycle rates of 1, 2, 3, 4 and 5 cycles per second. A cycle shall consist of poppet travel from closed to open to closed. The cycler shall include a counter for counting the cycles.  |
| 5.2.6         | Electrical Harness   |
|               | A moisture proof jumper assembly incorporating at one end two Bendix MGO6-8-4S plugs potted in accordance with RA0106-006. Each lead shall be identified according to valve (oxidizer or fuel) and pin (A, B, C or D). See Figure 1. This electrical harness shall be used whenever electrical power is supplied to the TCA. |
| 5.3           | Standard Pneumatic and Hydraulic Equipment (Ref. Fig. 2,3,4 & 11)  |
| 5.3.1         | Pressure Gages   |
|               | $G_1$ , $G_2$ - 0 to 600 psig, $\pm 1/4\%$ accuracy, full scale  |
| 5.3.2         | <u>Valves</u>  |
|               | $V_1$ , $V_2$ , $V_3 - 1/4$ hand valve, o to 1000 psig   |
|               |  |

| - 1 |              |         |                   |        |              |           |     |
|-----|--------------|---------|-------------------|--------|--------------|-----------|-----|
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| COMPONENT      | NAME THRUST CHAMBER ASSEMBLY - 25# PART NO. MAC 52-52701-265                                    |
|----------------|---|
| TEST NO        | 208160-401 PART NO. (NAA 208160-61 SHEET 23 OF 380  |
| 5.3.3          | Regulators SHEET OF 2   |
|                | R <sub>1</sub> - 1/4" pressure regulator, 0 to 1000 psig  |
| 5.3.4          | Filters   |
|                | F <sub>1</sub> - Filter, 10 micron absolute, stainless steel wire mesh                          |
|                | F <sub>2</sub> - Millipore filter, CA12 440 00; Housing, MS 28720-12                            |
| 5.4            | Standard Electrical Equipment   |
|                | (Equivalent items may be used)  |
| 5.4.1          | DC Power Supply - O to 36 VDC   |
| 5.4.2          | AC Power Supply - 110 VAC nominal, 60 cps   |
| 5.4.3          | Oscilloscope - Hewlett Packard, Model 122 AR, dual trace<br>(for Propellant Valve Functional)   |
| 5.4.4          | Switch - 40 watt minimum power rating   |
| 5.4.5          | High Voltage Leak Detector - Associated Research, Model 411                                     |
| 5.4.6          | Impedance Bridge - 0 to 50 ohms, + 1/10% accuracy   |
| 5.4.7          | Voltmeter - Hewlett Packard, Model 412A, 0 to 30 VDC and 0 to 100 VDC, + 1% full scale accuracy |
| 5.4.8          | Temperature Recorder - Leeds and Northrop, + 3% accuracy  |
|                |   |
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| FORM 608-B-40  | NEW 6-63  |

| COMPONENT NA                        | - ' - ' - ' - ' - ' - ' - ' - ' - ' - '   |
|-------------------------------------|---|
| TEST NO.                            | 208160-401 NAA SHEET 24 OF 380  |
| 5.4.9                               | Thermocouple - bare wire junction, accuracy class D defined in RAO201-050                                       |
| 5.5                                 | Standard Leakage Testing Equipment  |
| 5.5.1                               | Burette - 25 ml, 0.1 ml graduations   |
| 5.5.2                               | Beaker - 400 ml   |
| 5.6                                 | Miscellaneous Equipment   |
| 5.6.1                               | Pressure Test & Water Flow Fixture P/N T5034515   |
| 5.6.2                               | Camera - Polaroid (with oscilloscope adapter)   |
| 5.6.3                               | Propellant Valve Inlet Adapter - P/N 99-106126  |
| 5.6.4                               | Wall Temperature Test Chamber - P/N 99-208159   |
| 5.6.5                               | Scale - 0 to 25 pounds, 0.01 pound subdivisions   |
| 5.6.6                               | Stop Watch - One second subdivisions  |
| . 5.7                               | Special Equipment   |
| 5.7.1                               | High Response Thrust Fixture (including isolation Mass and Load Cell. (Kulite - Bytrex Load Cell JP1000 series) |
| 5.7.2                               | Two (2) Piston Flowmeters including LVDT's (Collins, 4 inch total travel)                                       |
| 5.7.3                               | Quantom Dynamics Bessel Low-Pass Filter (Type EBF -104)   |
|                                     |   |
|                                     |   |
| PREPARED BY:  E. Adams  CHECKED BY: | DATE APPROVED FOR NAA: DATE APPROVED FOR McDONNELL DATE   |
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#### ROCKETIDYNE

# DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT | NAME THRUST CHAMBER ASSEMBLY - 25# PART NO. { MAC 52-52701-265 208160-401 |
|-----------|---|
| 1631 110  | SHEET_2 OF 250  |
| 5.7.4     | 10 KC Excitation Source for LVDT's  |
| 5.7.5     | Demodulator Chassis for LVDT's  |
| 5.7.6     | Remotely Controlled Dead Weight Calibrator for Thrust Fixture             |
| 5.7.7     | CEC Type 33 Oscillograph Paper or Equivalent                              |
| 5.7.8     | Dymac DY 2401 Integrating Digital Voltmeter                               |
| 5.7.9     | Milliammeter, Weston Model 1951, 0-200 MA Range                           |

| PREPARED BY:    | DATE    | APPROVED FOR NAA: | DATE    | APPROVED FOR | McDONNELL | DATE |
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| E. Adams        | 4/10/64 | Dug               |         |              | <b></b>   |      |
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### ROCKETHYNE A DIVISION OF NORTH AMERICAN AVIATION. INC

## DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT NAME | THRUST CHAI:BER ASSEMBLY - 25# PART NO. { MAC _52-52701-265   NAA _208160-61  |
|----------------|---|
| NAME OF TEST   | OPERATIONAL TESTS AND PROCEDURES TEST NO. 208160-51 26 OF 380   |
| Reference:     | MAC SCD 52-52701, Revision F  |
| 6.0            | Operational Tests and Procedures  |
|                | This section contains the test procedures which shall be used in conjunction with the Environmental and Service Life Tests to demonstrate SCD compliance. |
|                |   |

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| COMPONENT NAI                       | PROPELIANT VALVE PROOF TRESSURE  |
|-------------------------------------|--|
| Reference:                          | MAC SCD 52-52701, Revision F, paragraph 6.2.3.1  |
| 1                                   | Propellant Valve Proof Pressure and Leakage  |
| 6.1.1                               | Install the TCA in a test setup as shown in Figure 2.  If the propellant valves have been removed from the TCA, they shall be equipped with propellant valve outlet adapters. Do not attach the leakage sensing line at this time. |
|                                     | NOTE: It shall be necessary to perform this test in a hazardous test cell. See paragraph 3.8.  |
| 6.1.2                               | Slowly adjust the regulated helium supply pressure at the oxidizer propellant valve inlet to $500  \frac{+10}{-0}$ psig as indicated by the pressure gage.   |
| 6.1.3                               | Maintain this pressure for a period of not less than three minutes.  |
| 6.1.4                               | De-pressurize the oxidizer propellant valve.   |
| 6.1.5                               | Adjust the regulated helium supply pressure to 150 ±10 psig.   |
| 6.1.6                               | Adjust the DC power supply to 26 ±0.5 VDC.   |
| 6.1.7                               | Cycle the exidizer propellant valve three times and leave in the closed position.  |
| 1.8                                 | Attach the leakage sensing line and arrange the leakage testing equipment as shown in Figure 2.  |
| 6.1.9                               | Adjust the regulated helium supply pressure to 500 +10 psig.   |
| •                                   |  |
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| FORM 608-B-38                       | NEW 6-63   |

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| COMPONENT NAME | THRUST CHAMBER ASSEMBLY - 25#   | _ PART NO. { MAC52-52701-265<br>NAA208160-61                    |
|----------------|---|---|
| NAME OF TEST   | PROPELLANT VALVE PROOF FRESCURE AND LEAKAGE   | _TEST NO. 208160-491EET 280F 38                                 |
|                | At first indication of leakage, wa to insure a steady leakage rate an leakage over a period of at least stopwatch. If no leakage is appar or if the measured leakage is less the leakage rate at "less than C.1 maximum allowable leakage is 2.23 | five minutes with a cent after five minutes than 0.5 ml, record |
| 6.1.11         | De-pressurize the oxidizer propell<br>the helium supply line, the DC pow<br>leakage sensing line. Cap the oxi<br>inlet port and electrical receptac   | er supply and the<br>dizer propellant valve                     |
| 6.1.12         | Failure to pass the above tests shof the oxidizer valve. See para   | all constitute a failure graph 3.6.1.                           |
| 6.1.13         | Repeat the above procedure on the   | fuel propellant valve.  |
| 6.1.14         | Remove the TCA from the test setup covers.  | o. Replace all protective                                       |
|                |   |   |

PREPARED BY: DATE

E. Adams 7-20-64

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| NAME OF TEST.   | THRUST CHAMBER PROOF PRESSURE  PART NO.   MAC 52-52701-265  NAA 208160-61   |
|---|---|
|   | TEST NO. 203160-SALET 29 OF 3   |
| Reference:  | MAC SCD 52-52701, Revision F, paragraph 6.3.1.1.10  |
| 6.2   | Thrust Chamber Proof Pressure and Leakage   |
| 6.2.1   | Install the TCA in a test setup as shown in Figure 3. NOTE: It shall be necessary to perform this test in a hazardous test cell. See paragraph 3.8.   |
| 6.2.2   | Close valve V,.   |
| 6.2.3   | Apply leak test compound to all welds on the TCA and to the transition joint between the stainless steel shell and the ablative material on the TCA nozzle exterior.  |
| 6.2.4   | Energize the fuel propellant valve with 12 ± 2 VDC.   |
| 6.2.5   | Slowly increase the regulated GN <sub>2</sub> supply pressure to 392 ± 10 psig. Maintain this pressure for a period of 3 ± .25 minutes. Evidence of leakage in the areas specified in paragraph 6.2.3, shall constitute a failure of the TCA. |
| 6.2.6   | Reduce the regulated GN pressure to zero and de-energize the  |
| 6.2.7   | Repeat paragraphs 6.2.3 through 6.2.6.  |
| 5.2.8   | Failure to pass the above test shall constitute a failure of the TCA. See paragraph 3.6.  |
| .2.9  | Wash residual leak test compound from the TCA with water and blow dry with GN2.   |
| .2.10   | Remove the TCA from the test setup and replace all protective closures.   |
| PARED BY: 44 Adams CKED BY: 6/11/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/ | DATE APPROVED FOR NAA: DATE APPROVED FOR MCDONNELL: DATE  1/10/64 DATE  1/10/64 DATE  |

| COMPONENT NAM | E THRUST CHAMBER ASSEMBLY - 25# PART NO. MAC 52-52701-265  |
|---------------|--|
| NAME OF TEST  | PROPELLANT VALVE ELECTRICAL RESISTANCE TEST NO. 208160-61 TEST NO. 208160 SHEET 30 OF 380  |
| Reference:    | MAC SCD 52-52701, Revision F, paragraph 6.2.3.2  |
| 6.3           | Propellant Valve Electrical Resistance   |
| 6.3.1         | Install the electrical harness on the propellant valves. Provide an environmental temperature of 70 ±5 F until temperature stabilization is obtained. Stabilization is defined as a temperature variation of not more than ±3 F for a 30 minute time period. |
| 6.3.2         | Adjust the impendance bridge to measure resistance.  |
| 6.3.3         | Measure and record the resistance between leads A and B of the oxidizer valve. The acceptable resistance is presented in Figure 9.   |
| 6.3.4         | Measure and record the resistance between leads C and D of the oxidizer valve. The maximum acceptable resistance is 1.0 ohm.   |
| 6.3.5         | Failure to pass the above test shall constitute a failure of the propellant valve. See paragraph 3.6.  |
| 6.3.6         | Repeat paragraphs 6.3.3 and 6.3.4 on the fuel valve.   |
| 6.3.7         | Remove Electrical harness from propellant valves and replace protective covers on propellant valve electrical connectors.  |
|               |  |

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| COMPONENT NAME   | THRUST CHAMBER ASSEMBLY - 25# PART NO.     MAC   52-52701-265  |  |  |  |  |
|--|--|--|--|--|--|
| Reference:   | MAC SCD 52-52701, Revision F, paragraph 6.2.3.3  |  |  |  |  |
| 6.4  | Propellant Valve Dielectric Strength   |  |  |  |  |
| 6.4.1  | Install the electrical harness on the propellant valves.  Attach ground leads to each of the propellant valve electrical connector bodies by means of alligator clips.   |  |  |  |  |
| 6.4.2  | Adjust the 60 cps AC voltage output of the leakage tester to zero.   |  |  |  |  |
| 6.4.3  | Set the capacity compensation selector switch on the leakage tester to "NONE".   |  |  |  |  |
| 6.4.4  | Connect one of the leakage tester leads to lead A of the oxidizer valve and the other lead to the oxidizer valve ground lead.  |  |  |  |  |
| 6.4.5  | Depress power switch on the leakage tester, and adjust the voltage control until 500 ±10 VRMS is indicated on the voltmeter. If the leakage tester ammeter reads off-scale, reduce the voltage until approximately 800 microamps is indicated on the ammeter.  |  |  |  |  |
| 6.4.6  | Rotate the capacity compensation selector switch until a minimum current flow is indicated on the ammeter.   |  |  |  |  |
| 6.4.7  | Adjust the voltage control until 500 +10 VRMS is indicated on the voltmeter.   |  |  |  |  |
| 6.4.8  | Observe the ammeter for a period of one minute. Maximum allowable current leakage is 500 micro-amps.   |  |  |  |  |
| 6.4.9  | Release the leakage tester power switch and disconnect the leakage tester leads.   |  |  |  |  |
| E. Adams CHECKED BY:  2/1/11/a. de 4/1 FORM 608-B-38 NEV | DATE APPROVED FOR NAA: DATE APPROVED FOR MCDONNELL: DATE OF THE PROPERTY OF TH |  |  |  |  |

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| COMPONENT NAME | THRUST CHAMBER ASSEMBLY - 25# PART NO SMAC 52-52701-265   |
|----------------|---|
|                | PROPELLANT VALVE DIELECTRIC NAA 208160-61   |
| NAME OF TEST   |   |
| ·              |   |
| 6.4.10         | Repeat paragraphs 6.4.2 and 6.4.3   |
| 6.4.11         | Connect one of the leakage tester leads to lead C of the oxidizer valve and the other lead to the oxidizer valve ground lead.     |
| 6.4.12         | Repeat paragraphs 6.4.5 through 6.4.9.  |
| 6.4.13         | Repeat paragraphs 6.4.2 and 6.4.3.  |
| 6.4.14         | Connect one of the leakage tester leads to lead A of the oxidizer valve and the other to lead C of the oxidizer valve.            |
| 6.4.15         | Repeat paragraphs 6.4.5 through 6.4.9.  |
| 6 <b>.4.16</b> | Failure to pass the above test shall constitute a failure of the propellant valve. See paragraph 3.6.                             |
| 6.4.17         | Repeat paragraphs 6.4.2 through 6.4.15 on the fuel valve.   |
| 6.4.18         | Remove the electrical harness and the ground leads from the propellant valves and replace the propellant valve protective covers. |
| 6.4.19         | Replace protective caps.  |
|                |   |
|                |   |
|                |   |

| COMPONENT NAME                    | THRUST CHAMBLE ASSEMBLY - 25# PART NO. \ MAC 52-52701-265   |  |  |  |  |
|-----------------------------------|---|--|--|--|--|
| NAME OF TEST                      | PROPELLANT VALVE FUNCTIONAL TEST NO. 202160-401 33 of 380   |  |  |  |  |
| Reference:                        | MAC SCD 52-52701, Revision F, paragraph 6.3.1.3.1   |  |  |  |  |
| 6.5                               | Propellant Valve Functional   |  |  |  |  |
| 6.5.1                             | Install the TCA in a test setup as shown in Figure 4. Provide a temperature environment of 70 ±5 F until temperature stabilization is obtained. Stabilization is defined as a temperature variation of not more than ±3 F for a 30 minute time period. Connect the current trace lead to the oxidizer valve. Do not connect the voltage trace lead. |  |  |  |  |
| 6.5.2                             | Adjust the pressure regulator to obtain 300 $\pm$ 10 psig on the pressure gage.   |  |  |  |  |
| 6.5.3                             | Adjust the DC power supply so that 26 ±0.5 VDC is read on the voltmeter.  |  |  |  |  |
| 6.5.4                             | Close the mercury switch and record the oscilloscope current trace with the Polaroid camera. A sample current trace is shown in Figure 5. The maximum valve opening response time is 0.0065 seconds from electrical signal to poppet open. See Figure 5 for typical valve opening response characteristics. Open the mercury switch.                |  |  |  |  |
| 6.5.5                             | Reduce the GN2 supply pressure to zero.   |  |  |  |  |
| 6.5.6                             | Disconnect the current trace lead and connect the voltage trace lead.   |  |  |  |  |
| 6.5.7                             | Close the mercury switch to verify that the oxidizer valve has opened. Then open the mercury switch and record the oscilloscope voltage trace with the Polaroid camera. A sampling voltage trace is shown in Figure 5. The maximum valve closing response time is 0.0035 seconds from electrical signal to poppet closed.                           |  |  |  |  |
| PREPARED BY: E. Adams CHECKED BY: | DATE APPROVED FOR NAA: DATE APPROVED FOR McDONNELL: DATE  7-20-64 DATE  A 8-3-64  A 8-3-64  |  |  |  |  |

| COMPONENT NAME | THRUST CHAMBER ASSENBLY - 25#  PROPELLANT VALVE FUNCTIONAL  TEST NO 202160-401 SHEET 34 OF 380   |
|----------------|--|
| 6.5.8          | Adjust the Gi2 supply pressure to 300 ±10 psig.  |
| 6.5.9          | Adjust the DC power supply voltage to zero.  |
| 6.5.10         | Close the mercury switch.  |
| 6.5.11         | Increase the DC power supply voltage until the oxidizer valve opens as indicated by a pressure drop. The maximum acceptable pull in voltage is 16 VDC as indicated on the output voltmeter.                              |
| 6.5.12         | Reduce the GN2 supply pressure to zero.  |
| 6.5.13         | Reduce the DC power supply voltage until the propellant valve closes. Note deflection on milliammeter which indicates valve closing. Record valve closing voltage. The minimum acceptable drop out voltage is 1.0 volts. |
| 6.5.14         | Open the mercury switch.   |
| 6.5.15         | Failure to pass the above test shall constitute a failure of the oxidizer valve. See paragraph 3.6.  |
| 6.5.16         | Repeat paragraphs 6.5.1 through 6.5.15 on the fuel propellant valve.   |
| 6.5.17         | Remove electrical leads and the GN <sub>2</sub> supply.  |
| 6.5.18         | Replace all protective closures.   |
|                |  |

PREPARED BY: APPROVED FOR MCDONNELL: DATE APPROVED FOR NAA: E. Adams 7-20-14 DATE Fide 8-4-64 CHECKED BY: FORM 608-B-38 NEW 6-63

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#### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

THRUST CHAMBER ASSEMBLY - 25# COMPONENT NAME. PART NO. WEIGHT DETERMINATION TEST NO. 208160-401 SHEET 35 OF 380 NAME OF TEST.

MAC SCD 52-52701, Revision F, paragraph 6.3.1.4.1 Reference:

6.6 Weight Determination

6.6.1 Weigh the TCA to the nearest one-hundredth (0.01) pound in accordance with RAO220-290 and record.

|                           |                   |          | •                       |      |
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| FORM 608-B-38 NEW 6-63    | <u> </u>          | <u> </u> |                         |      |

| COMPONENT NAME THRUST CHAMBER ASSEVBLY - 25# PART NO. MAC 52-52701-265   |
|--|
| THRUST CHAMBER ASSEMBLY  NAME OF TEST FIRING PROCEDURE  TEST NO.208160-61  TEST NO.208160-61  TEST NO.208160-61  |
| 1231 NO.200200- SHEET 30 OF 300  |
| Reference: MAC SCD 52-52701 RevisionF, paragraph 6.3.1.3.2.2   |
| 6.7 2 Chrust Chamber Assembly Firing Procedures  |
| 6.7.1 Install the TCA in a thrust mount located in a hot fire test   |
| installation equipped with instrumentation per Table I.  Pressure check all connections using GN2 at 50 ±10 psig, seal   |
| assembly 9017831, and leak test compound.  |
| 6.7.1.1 For cape cycle firings, the firing duration shall be controlled  |
| \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\   |
| schematically in Figure 6.   |
| 6.7.1.2 For DAT duty cycle firings the firing control shall be automatic.  |
| The pulse sequence and duration shall be according to the schedule of Table II. The required propellant feed system is   |
| shown schematically in Figure 6.   |
| 6.7.1.3 For impulse signal width tests, the firing control system shall  |
| be controlled by the pulse generator. The required propellant  |
| feed system is shown schematically in Figure 6.  |
| 6.7.2 Open facility propellant valves.   |
| $i \in \mathcal{I}_{\omega}$   |
|  |
| 6.7.4 Open the oxidizer bleed valve to bleed entrained gas from the  |
| oxidizer feed system. Continue bleeding until entrained gas is eliminated as evidenced by a steady oxidizer flowmeter signal.  |
| A China Chin |
| Fare the second  |
| 6.7.6 Repeat paragraphs 6.7.4 and 6.7.5 on the fuel feed system.   |
|  |
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| COMPONENT NAME   | THRUST CHAMBER ASSEMBLY | - 25# PART NO. | MAC 52-52701-265<br>NAA 203160-61<br>208160- SHEET37 OF 380 |
|--|-------------------------|----------------|---|
| COM ONEIT HAME   | THRUST CHAMBER ASSEMBLY | PART NO.       | L NAA 2033.60-62  |
| NAME OF TEST   | FIRING PROCEDURE        | TEST NO.       | 208160-SHEET37 OF 380                                       |
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6.7.7 Activate altitude chamber to achieve and maintain a simulated pressure altitude of 100,000 feet or greater. If the firing is to be cape cycle the pressure altitude shall be local ground level.

6.7.8 Make final propellant tank pressure adjustments to obtain the required TCA inlet pressures during steady state operation as follows:

Oxidizer Inlet Pressure 2.92 ±10 psia Fuel Inlet Pressure 2.92 ±10 psia

6.7.9 Turn on instrumentation. The parameters tabulated in Table I. Shall be monitored and recorded during the hot fire test.

6.7.10 Fire TCA as required to accomplish test objectives.

6.7.11 Immediately following termination of firing reduce pressure altitude to local ground level conditions. Close the facility propellant valves and adjust GN2 purge pressurant to 120 ±10 psig.

- NOTE: (1) Maintain altitude following the completion of the DAT
  Duty Cycle to minimum duration. Record temperature data
  during the soak out period of 20 ±5 minutes. After soak
  out temperature is reached complete the Hot Fire Burst
  Pressure Test procedure of paragraph 7.2.4. TCA skin
  temperature must not exceed 700 of after MDC soakout.
  - (2) Maintain altitude following the completion of the DAT Duty Cycle to Guaranteed Life. Record temperature data during the soak out period of 20 ±5 minutes. No failure criteria shall be attached to the scakout temperature after the MDC to guaranteed life.

|                 |          | <u>.</u>          |         |                         | •    |
|-----------------|----------|-------------------|---------|-------------------------|------|
| PREPARED BY:    | DATE     | APPROVED FOR NAA: | DATE    | APPROVED FOR MCDONNELL: | DATE |
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|---------------------|--|----------------------------|----------------------|------------|
|                     | THRUST CHAMBER ASS                               | EMBLY - 25#<br>PAI         | RT NO. MAC 20816     |            |
| COMPONENT NAME      | THRUST CHAMBER ASS                               | EVELY                      | LNAA                 | 38 or 380  |
| NAME OF TEST        | FIRING PROCEDURE                                 | TE                         | ST NO. 208160_SHEET  | 20 OF 200  |
| 6.7.12              | Open the propellant bl<br>period of 30 seconds ( | leed valves and (minimum). | purge with GN2 for   | •          |
| 6.7.13              | Close the propellant                             |                            |                      |            |
|                     | Cycle the TCA exidizer and leave in the open     | position.                  |                      |            |
| 22                  | Continue to purge for throughout.                |                            |                      | conditions |
| 6.7.16              | Close the TCA oxidize                            | r and fuel valv            | 768.                 |            |
| 6.7.17              | Secure the test facil                            |                            | • .                  |            |
| 6.7.18              | Remove the TCA from t                            | he hot fire ter            | st installation.     |            |
|                     |  | •                          |                      |            |
|                     |  |                            |                      | •          |
|                     |  | •                          |                      | <u> </u>   |
|                     | •  |                            | •                    |            |
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|---|--|-------------------------------|--|--|--|--|
| COMPONENT NAME  | THRUST CHAMBER ASSEMBLY  | PART NO.                      | 202160 63  |  |  |  |
| NAME OF TEST  | DECONTAMINATION PROCEDURE  | TEST NO.208160                | 52-52701-265<br>208160-61<br>201<br>SHEET <sup>39</sup> OF 360 |  |  |  |
|   |  |                               | •  |  |  |  |
|   | ntamination Procedure  |                               | ·  |  |  |  |
| Z. A. Durge   | CCA shall be decentaminated as and anhydrous isopropl alcount the fuel side flush and feon | MOI I CARCILO RIGAGE          | 100  |  |  |  |
| note<br>a   | : The hot GN <sub>2</sub> purge may be a test facility.                                    | accomplished at the           | hot fire   |  |  |  |
| 6.8.2 Atta  | ch 10 VDC (nominal) electrical connec  | al power supply lead<br>tors. | s to the   |  |  |  |
| para  | ect GN2 purge line to the ox graph 3.8.  | idizer valve inlet.           | See  |  |  |  |
|   | the GN2 supply valve and putes using 12 ±2 VDC to open                                     |                               | e for ten  |  |  |  |
| NOTE  | : The GN <sub>2</sub> pressure and temp<br>shall be 120 ±20 psig and                       |                               |  |  |  |  |
| 6.8.5 Open  | the GN <sub>2</sub> supply valve and puten (10) cycles.                                    | rge the oxidizer sid          | e as follows   |  |  |  |
| . (a)<br>(b)  | 5 +1 seconds on-time<br>5 +1 seconds off-time  |                               |  |  |  |  |
| 400   | NOTE: The GN <sub>2</sub> pressure and temperature, will be same as paragraph 6.8.4.       |                               |  |  |  |  |
| 6.8.6 Close the GN <sub>2</sub> supply valve and vent the GN <sub>2</sub> downstream of the supply valve. |  |                               |  |  |  |  |
| 6.8.7 Disconnect the supply line from the oxidizer valve.   |  |                               |  |  |  |  |
| PREPARED BY:  R. Cole  CHECKED BY:  | DATE APPROVED FOR NAA:   | DATE APPROVED FOR MC          | DONNELL: DATE  |  |  |  |
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|--|--|--|--|
| COMPONENT NAME.  | THRUST CHAMBER A   | SSENBLY                                | PART NO. \( \begin{array}{ll} MAC & \frac{52-52701-265}{208160-61} \end{array} |
| NAME OF TEST   | DECONTAMINATION  | PROCEDURE                              | TEST NO. 208160-511<br>TEST NO. 208160-5HEET 400F 380                          |
| 6.8.8 Cap  | the valve adapter  | and disconnect t                       | the electrical connector.  |
| 6.8.9 Cap  | est paragraph 6.8.   | through 6.8.8 c                        | on the fuel valve.   |
| 6.8.10 <b>T</b> ns   | tall the TCA in the  | e decontamination                      | n facility.  |
| 6.8.11. Att  | ach the facility a   | lcohol supply lir                      | ne to the TCA fuel valve.  |
| 6.8.12 Cap   | the TCA oxidizer   | inlet line.                            |  |
| con  | nect the harness to  | o the DC power su                      | propellant valves and upply.   |
| 6.8.14 Ene   | rgize the TCA fuel   | valve to the ope                       | en position with 12 ±2 VDC.  |
| 6.8.15   | w alcohol through  | the TCA for 2 +1                       | minutes. The alcohol re of 35 to 50 psig.                                      |
| 6.8.16 (Flow using the state of | y alcohol throughing 26 ±1 VDC at a  | the TCA as follow<br>TCA inlet pressur | ws for ten (10) cycles,<br>re of 35 to 50 psig.                                |
| , (b)  | 5 ±1 seconds on-<br>5 ±1 seconds off   | - time                                 |  |
| 6.8.17 De2   | energize the TCA for<br>ohol supply system,<br>to<br>ove the facility although the TCA fuel valve. | uel valve to clos                      | sed position and vent the  |
| 6.8.18 ? (Tem  | the the facility at<br>the TCA fuel valve  | lcohol line and a                      | attach the GN <sub>2</sub> supply line   |
| 6.8.19 Fine  | rgize the TCA fuel   | valve to the ope                       | en position with 12 ±2 VDC.  |
|  | . V  | •                                      | 120 +10 psig for 3 minutes.  |
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R-15019-2

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| COMPONIENT NAME | THRUST                     | CHAMBER ASSEMBLY                        |                        | MAC 52-52701-26                                  | .5       |
|-----------------|----------------------------|---|------------------------|--|----------|
| COMPONENT NAM   |                            |   |                        | PART NO. { NAA 2001c0-61                         |          |
| NAME OF TEST_   | DECONTA                    | MINATION PROCEDURE                      |                        | TEST NO 208160 SHEET 40.                         | 380      |
| 6.8.21          | Cycle valve<br>psig as fol | ten (10) times wi<br>lows using 26 ±1 V | th GN <sub>2</sub> at  | a pressure of 120 ±10                            |          |
| _               |                            | econds on-time econds off-time          | . · .                  |  | •        |
| 6.8.22          | De-energize                | the TCA fuel valv                       | re to the              | closed position.                                 |          |
| 6.8.23          | Disconnect inlet.          | GN <sub>2</sub> line from TCA           | fuel valv              | e and cap the fuel valve                         |          |
| 6.8.24          | Remove cap                 | from TCA oxidizer                       | valve inl              | et.  | <i>I</i> |
| 6.8.25          | Attach Fred                | on TF supply line t                     | o TCA oxi              | dizer valve inlet.                               | •        |
| 6.8.26          | Energize T                 | A oxidizer valve t                      | to open po             | sition with 12 ±2 VDC.                           |          |
| 6.8.27          | Flow Freon be flowed a     | TF through the TCA inlet pres           | for 2 +1<br>ssure of 3 | minutes. The Freon shall to 50 psig.             | u        |
| 181 000         | f "                        |   |                        | ows for ten (10) cycles,<br>re of 35 to 50 psig. |          |
| _               | (a) $5 \pm 1$ :            | seconds on-time seconds off-time        |                        |  |          |
| 14. C           | Freon supp                 | ly system.                              |                        | sed position and vent the                        |          |
| 6.8.30          | Disconnect oxidizer i      | Freon Supply line                       | and attac              | ch GN <sub>2</sub> supply to TCA                 |          |
| 6.8.31          | Energize t                 | he TCA oxidizer va                      | lve to ope             | en position with 12 ±2 VD                        | c.       |
|                 |                            |   | <del></del>            |  |          |
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| COMPONENT NAME THRUST CHAMBER ASSEMBLY PART NO. [ MAC 52-52701-265   |
|--|
| DECONTAMINATION PROCEDURE 2007-601   |
| NAME OF TEST NO. 2001CU SHEET 41 OF 380  |
| 6.8.32 Purge the TCA with GN <sub>2</sub> at a pressure of 120 +10 psig for 3  |
| 6.8.33 © Cycle valve ten (10) times with GN <sub>2</sub> at a pressure of 120 ±10 , psig as follows using 26 ±1 VIC.   |
| (a) 5 ±1 seconds on-time (b) 5 ±1 seconds off-time   |
| 6.8.34 De-energize the TCA oxidizer valve to closed position.  |
| 6.8.35 Remove the GN2 supply line from the TCA oxidizer valve and cap the oxidizer valve inlet.  |
| 6.8.36 Connect 10 VDC (nominal) power supply to the TCA fuel valve so that the propellant valves may be energized simultaneously.  |
| 6.8.37 Duncap both TCA propellant inlets and place TCA in a vacuum oven.   |
| 6.8.38 Attach temperature sensing elements to one propellant valve and the injector upper face.  |
| 6.8.39 Heat the TCA to indicated temperature of 150 ±10 F.   |
| 6.8.40 Energize both TCA propellant valves and activate the vacuum equipment so that the TCA is subjected to an internal pressure  |
| of one (10) psia or less for a period of not less than fifteen (15) minutes. The TCA valve and injector temperature shall be maintained at 150 ±10 F during the specified time period. |
| 6.8.41 Remove electrical leads and install all protective covers.  |
| ••   |
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| COMPONENT NA | THRUST CHAMBER ASSEMBLY - 25# PART NO. \ MAC 52-52701-265  |
|--------------|--|
| NAME OF TEST | ENVIRONMENT AND SERVICE LIFE TESTS 2007-607-401 13 2 200   |
|              |  |
| 6.9          | Propellant Valve Orifice Removal   |
| 6.9.1        | Remove oxidizer and fuel valve tube assemblies (P/N 407571) from TCA.  |
| 6.9.2        | Remove retaining rings and orifices.   |
|              | NOTE: Use caution in removing orifices to prevent damage. (Reference paragraph 3.8 for cleanliness requirements) |
| 6.9.3        | Package and identify each orifice and retaining ring.  |
| 6.9.4        | Reweld tube assemblies to the propellant valves.   |
| 6.9.5        | Secure packaged orifices and retaining rings to the applicable valves.   |
| 6.9.6        | Perform 500 psig leak check to verify structural integrity of weld joints.                                       |
| 6.9.7        | Reidentify TCA 208160-61 as 208160-61 DAT.   |

| 1 |              |         |                   |         |                         |      |
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| COMPONENT NAME | THRUST CHAMBER ASSEMBLY - 25# PART NO. { MAC 52-52701-265 NAA 208160-61  |
|----------------|--|
| NAME OF TEST   | PROPELLANT VALVE LOAD ANALYSIS TEST NO 208160-SHEET 20F380   |
| Reference:     | MAC SCD 52-52700, Revision G, Paragraph 6.1.2.   |
| 6.10           | Propellant Valve Load Analysis   |
| 6.10.1         | Install the propellant valve in a test setup as shown in Figure 14 Connect the oscillograph to monitor propellant valve current and voltage versus time. Set the "PULL IN - DRCP OUT" switch of the propellant valve test panel to "PULL IN". Leave the line switch in the open position. See paragraph 3.8. |
| 6.10.2         | Adjust the regulated GN2 supply pressure to 300 ±10 psig.  |
| 6.10.3         | Set "VALVE DC PUNER" switch to "ON".   |
| 6.10.4         | Adjust DC power supply so that 20 ±0.5 VDC is indicated on the output voltmeter.   |
| 6.10.5         | Set "VALVE DC POWER" switch to "OFF" and close the line switch.  |
| 6.10.6         | Adjust oscillograph paper speed for 60 inches per second. Activate the oscillograph.   |
| 6.10.7         | By use of the "VALVE DC POWER" switch energize the propellant valve for approximately 200 milliseconds or more to obtain oscillograph traces of current and voltage versus time. The trace shall include energize and de-energize transients and steady state conditions.                                    |
| 6.10.8         | Deactivate the oscillograph and inspect the oscillograph traces to determine the voltage and the current at that point in time which makes the power a maximum. Power in watts is defined as the product of voltage in volts and current in amps. Record the current, voltage and power on the data sheet.   |

FORM 608-B-38 NEW 6-63

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APPROVED FOR NAA:

PREPARED BY:

APPROVED FOR MCDONNELL:

#### ROCKETDYNE

## DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT NAMI | E THRUST CHAMBER ASSEMBLY PART NO   |
|----------------|---|
| NAME OF TEST   | PROPELLANT VALVE LOAD ANALYSIS TEST NO 208160-\$HEE \$1.30F380  |
| .6.10.8.1      | Load analysis is performed primarily for information purposes. However, a requirement exists that when this test is run at valve body temperatures of 160F the power consumption of the propellant valve shall not exceed 20 watts when the energizing voltage is 26 +4 VDC. Failure to pass this requirement shall constitute a failure of the propellant valve. |
| 6.10.9         | Record on the oscillograph trace the propellant valve serial number, the applied voltage and the environmental temperature.   |
| 6.10.10        | Repeat paragraphs 6.10.3 through 6.10.9 for voltages of 22, 24, 26, 28, 30 and 33 VDC.  |
| 6.10.11        | Reduce the regulated GN <sub>2</sub> supply pressure to zero.   |

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#### ROCKETBYNE A DIVISION OF NORTH AMERICAN AVIATION INC

### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT NAM | E THRUST CHAMBER  | ASSEMBLY - 25# | PART NO. | MAC 52-52701-265<br>NAA 208160-61 |
|---------------|-------------------|----------------|----------|-----------------------------------|
| NAME OF TEST  | ENVIRONMENTAL AND | SERVICE LIFE   |          | 208160-SHEET 42 OF 380            |

Reference: a) MAC SCD 52-52701, Revision F, Figure 12

7.0 Environmental and Service Life

In this section the required environment, service life and operational tests are specified for each of the three TCAts. Sheets are provided for the recording of environmental and service life data and the data of the operational tests required to demonstrate specification compliance.

| 1 |              |           |                   |          | ·                       |      |
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|   |              |           |                   |          |                         |      |

#### ROCKETDYNE

### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT NAME _ | THRUST CHAMBER ASSEMBLY - 25# | PART NO. { MAC 52-52701-265 208160-61                      |
|------------------|-------------------------------|--|
|                  |                               | E TESTS (NAA 401 43 OF 380 TEST NO. 208160-SHEET 43 OF 380 |

Reference:

MAC SCD 52-52701, Revision F, Figure 12

7.1

Thrust Chamber Assembly No. 1

This sub-section specified the tests which are to be performed on TCA No. 1.

| l                    |                   |          |                         |      |
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|                          | TUDIOS OULASTO ACODISTA OS  | (MAC_52-52701-265   |
|--------------------------|---|---|
| COMPONENT NAME           | THRUST CHAPBER ASSEMBLY - 25#   | PART NO. ( NAA 208160-61  |
| NAME OF TEST             | PRF-TEST INSPECTION   | TEST NO. 208160 SHEET 44 OF 380   |
| Reference:               | MAC SCD 52-52701, Revision F, para  | agraph 6.2.2.1  |
| 7.1.1                    | Pre-Test Inspection - TCA #1  | ·   |
| 7.1.1.1                  | Test Procedure  | •   |
| 7.1.1.1.1                | Verify that the TCA is of the propassed the Acceptance Tests of Rock RA0220-354. Only the TCA's that coments shall be accepted for DAT.                                       | ketdyne specification   |
| 7.1.1.2                  | Record the Rocketdyne Part Number   | and Serial Number of the TCA.   |
| 7.1.1.3                  | Record the Rocketdyne Part Number oxidizer propellant valve.  | and Serial Number of the  |
| 7.1.1.4                  | Record the Rocketdyne Part Number fuel propellant valve.  | and Serial Number of the  |
| 7.1.1.1.5                | Record the McDonnell Part Number o  | f the TCA.  |
| 7.1.1.6                  | Inspect the TCA for visual evidenc Comment or all visual defects.   | e of damage or deterioration.   |
| 7.1.1.1.7                | Braze the extended propellant valv (P/N 99-106694 and 99-106695) to t tube stubs as defined in Rocketdyn RAOCO7-009. Remove after vibratio tube adapters (P/N 99-106126) to T | the fuel and oxidizer inlet the process specification on test and braze basic inlet |
| 7.1.1.1.8                | Perform weight determination on To adapters per paragraph 6.6.  | A with basic inlet tube   |
|                          |   |   |
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| COMPONENT NAME | THRUST CHAMBER ASSEMBLY - 25# PART NO. { MAC   52-52701-265     208160-61   |
|----------------|---|
| 7.1.1.2        | Test Results - TCA #1   |
| 7.1.1.2.1      | Component Identification Oxidizer Fuel  |
|                | Component Name TCA Valve Valve  |
|                | McDonnell Part No. 52-52 x-1-265 (8.5)  |
|                | Rocketdyne Part No. 208160-61 4059625 40756 0   |
|                | Component Serial No. 4057233 9193579 407559   |
| 7.1.1.2.2      | Inspection (reference paragraph 7.1.1.1)  |
| 7.1.1.2.2.1    | The TCA was inspected and found to be of the proper configuration and had passed the acceptance tests of RAC 220-354.  YES (Test or No) $\frac{27}{6}$                          |
| 7.1.1.2.2.2    | The extended inlet tube adapters were installed on the propellant valves per paragraph 7.1.1.1.7 for vibration tests only.  NO (Yes or (No) KEF PARA, 7/1/2.2.4                 |
| 7.1.1.2.2.3    | The extended inlet tube adapters were removed from the propellant valves following the vibration tests and the basic inlet tube adapters installed on the TCA. YES (Yes) or No) |
| 7.1.1.2.2.4    | Inspection Remarks  |
| (315) 8/27/    |   |
|                | 100 PER IL 4288-5100. The 99-106694 29910695 THEE WIET  |
|                | ADAPTERS HAVE NO BY OR INSPECTION VERIFICATION OF THE PURPLE  |
| E. Adams 5/24  | TE PERFORMED BY DATE WITNESSED FOR NAM DATE CERTIFIED FOR MCDONNELL DATE OF CONTROL 14/16/2014 (1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/  |

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| COMPONENT NAME      | THRUST CHAMBER ASSEMBLY - 25# PART NO MAC 52-52701-265   |
|                     | NAA 208160-61  |
| NAME OF TEST        | TEST NO. 208160 SHEET 46 OF 380  |
|                     |  |
| 7.1.1.2.3           | Weight Determination Test Data (reference paragraph 6.6)   |
|                     | All protective closures were removed from the TCA.   |
|                     | YES (Yes or No)  |
| •                   |  |
|                     | The TCA dry weight was 3.18 pounds. (Record to the nearest one-hundredth pound).   |
|                     |  |
| •                   | Inspection Remarks   |
|                     | NONE 9-9-64 (3)  |
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| COMPONENT NAM | E THRUST CHAMBER ASSEMBLY - 25# PART NO. { MAC 52-52701-265   NAA 208160-61   VIBRATION TEST NO. 208160-8HEET 47 OF 380  |
|---------------|--|
| REFERENCE:    | M. SCD 52-52701, Ravision F, Paragraph 6.2.3.17.3  |
| 7.1.2         | Vibration - TCA #1   |
| 7.1.2.1       | Test Procedure   |
| 7.1.2.1.1     | Install the TCA into the vibration test facility. The direction of the vibration input shall be along the X axis of the TCA (see Figure 7).  NOTE: Remove nameplate and mount accelerometer. Replace |
|               | nameplate at new location on TCA.  |
| 7.1.2.1.2     | Perform a sine wave survey on the thrust chamber.  |
| 7.1.2.1.2.1   | The survey shall be a one (1) G meximum peak logarithmic sweep from 5 to 2000 cps in 5 ±1 minutes.   |
| 7.1.2.1.2.2   | Record the input and output accelerations on an oscillographcorder.  |
| 7.1.2.1.3     | Performation table equalization run at the test level to verify spectrum shape and tolerance.  |
| 7.1.2.1.3.1   | Record and analyze the data.   |
| 1.1.2.1.3.2   | The random vibration input shall be per Figure 8.  |
| 7.1.2.1.3.3   | The power spectral density is to be the specified value with a plus forty (40) percent and minus thirty (30) percent tolerance when analyzed with 1/3 - octave or narrower filters.                  |

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| COMPONENT NAME _ | THRUST CHAMBER ASSEMBLY - 25# PART NO. MAC 52-52701-265   |  |  |
|                  | NAA 208160-61   |  |  |
| NAME OF TEST     | TEST NO. 208160 SHEET 48 OF 380   |  |  |
| 7.1.2.1.3.4      | The overall RMS acceleration level is to be 7.5 G's, plus fifteen (15) percent, minus zero (0) percent.   |  |  |
| 7.1.2.1.3.5      | No smaller than three (3) sigma clippers shall be used to limit the input level.  |  |  |
| 7.1.2.1.4        | Readjust the controls and repeat paragraphs 7.1.2.1.3 and 7.1.2.1.3.1 as required to conform to paragraphs 7.1.2.1.3.2 through 7.1.2.1.3.4.   |  |  |
| 7.1.2.1.4.1      | Test level equalization time for the purpose of verifying the spectrum shape shall not exceed twenty (20) percent of total test duration for each individual axis.  |  |  |
| 7.1.2.1.5        | Vibrate the TCA with the random vibration input established in paragraph 7.1.2.1.4 for a duration of eight (8) ±0.1 minutes less the time accumulated, for each respective axis, in paragraphs 7.1.2.1.3 and 7.1.2.1.4. |  |  |
| 7.1.2.1.5.1      | Record and analyze the input and output accelerations at selected intervals.  |  |  |
| 7.1.2.1.6        | Repeat paragraphs 7.1.2.1.1 through 7.1.2.1.5.1 except that the direction of vibration input shall be along the Y axis (see Figure 7.)  |  |  |
| 7.1.2.1.7        | Repeat paragraphs 7.1.2.1.1 through 7.1.2.1.5.1 except that the direction of vibration input shall be along the Z axis (see Figure 7).  |  |  |
| 7.1.2.1.8        | Remove the TCA from the test setup.   |  |  |
| 7.1.2.1.9        | Perform Propellant Valve Proof Pressure and Leakage Test per paragraph 6.1.   |  |  |
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| COMPONENT NAME | THRUST CHAMBER ASSEMBLY - 25#                                | PART NO. { MAC                 |
|----------------|--|--------------------------------|
| NAME OF TEST   | VIBRATION  |                                |
| 7.1.2.1.10     | Perform Thrust Chamber Proof : per paragraph 6.2.            | Pressure and Leakage Test      |
| 7.1.2.1.11     | Perform Propellant Valve Elec<br>per paragraph 6.3.          | trical Resistance Test         |
| 7.1.2.1.12     | Perform Propellant Valve Diel paragraph 6.4.                 | ectric Strength Test per       |
| 7.1.2.1.13     | Perform Propellant Valve Func                                | tional Test per paragraph 6.5. |
| 7.1.2.1.14     | Remove the extended inlet tube basic inlet tube adapters per |                                |
| 7.1.2.1.15     | Perform Weight. Determination p                              | per paragraph 7.1.1.1.8.       |
| · ·            |  |                                |

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| NAME OF TEST    | THRUST CHANGER ASSEMBLY VIBRATION |                       | C 11/2     | AA 208160-<br>160 -/Cl<br>SHEET |          |             |
|-----------------|-----------------------------------|-----------------------|------------|---------------------------------|----------|-------------|
| 7.1.2.2         | Test Data - TCA #1                | THE TAXABLE PROPERTY. |            |                                 |          |             |
| 7.1.2.2.1       | Component Identification          | oa "                  |            |                                 |          |             |
|                 | Component Name                    | TCA                   |            | •                               |          |             |
| * .             | McDonnell Part No.                | 52-52                 | 701-26     | 5-                              |          |             |
| · ·             | Rocketdyne Part No.               |                       |            |                                 |          |             |
|                 |                                   |                       |            |                                 |          |             |
|                 | Component Serial No.              | 7040                  | <u> </u>   | •                               |          |             |
| 7.1.2.2.2       | Accelerometer Identific           | <u>cation</u> (Re     | ference Fi | gura 7)                         |          | ٠           |
|                 | Location .                        | Sensi<br>Æti          |            | Identific No.                   | ation    |             |
|                 | TCA Input                         | X                     | 3          | 9N 113                          | (1.8.3)  |             |
|                 | TCA Input                         | Y                     |            | /N 113                          | 7        | -           |
| •               | TCA Input                         | Z                     | 3          | N 113                           | -        |             |
| •               | Valve Bracket                     | Х                     | 1 3        | N 1930                          | 1        | <del></del> |
|                 | Valve Bracket                     | Y                     | 3          | /N 1327 -                       | <b>E</b> |             |
|                 |                                   |                       | _   -      |                                 |          |             |
|                 | TCA Shell at Comb. Zon            | χ c                   |            | NA 1090                         | (E.S.)   |             |
|                 | TCA Shell at Comb. Zon            | e Y                   |            | W_ 1/27                         | A        |             |
|                 | 76A Shell at Comb. Zon            | е 2                   |            | /N. 1119-                       |          |             |
|                 | TCA Shell at Exit                 | Х                     |            | W 903                           |          |             |
|                 | TCA Shell at Exit                 | Y                     |            | 3/N 1005                        |          |             |
|                 | TCA Shell at Fxit                 | <b>Z</b> ,            |            | 5/N 744                         | (£,3)    |             |
| •               |                                   |                       |            |                                 |          |             |
|                 |                                   |                       |            |                                 |          |             |
| REPARED BY DATE | PERFORMED BY DATE WITHE           | SSED FOR NAA          | DATE CER   | TIFIED FOR ME                   | DONNELL  | ,DA         |
| T.G. Kniffin    | 9-2-6                             | 9-2-                  | 9 4        | D. Marrog                       | emo 7    | 123         |
|                 |                                   |                       | √          | 11 12 1 SV 1154 B               | ī        | D.          |

FORM 608-B-39 NEW 6-63

REVISION A T. April Dated 8-31-64

R-15019-2

203/

|                   |                 |                | •                      |                          | •              |                      |
|-------------------|-----------------|----------------|------------------------|--------------------------|----------------|----------------------|
| COMPONENT NAME _  | THRUST          | CHAMBER        | ASSEMBLY -             | - 25# PART N             | MAC 52         | -52701-265           |
|                   | VIBRATI         | on             |                        |                          | CNAC ZOO       | •7.():               |
| NAME OF TEST      |                 |                |                        | TEST N                   | 0.203160 8     | HEET 51 OF 380       |
| 7.1.2.2.3         | <u>Vibrati</u>  | on Test        | (Reference             | ce paragraph 7           | .1.2.1)        |                      |
| 7-1.2.2.3.1       | Resonan         | t Survey       | y - X Axis             |                          |                | •                    |
| •                 | Freq. cps       | Input<br>g*s   | Output<br>g's          | Identificat (no)         |                |                      |
|                   | 236             | 1.0            | 14.0                   | S/N. 903 (               | 3 17           |                      |
|                   | 300             | 1.0            | 4.2                    | 5/N 903                  |                | •                    |
| . •               | 360             | 1.0 ·          | 9.3                    | 7N 1070                  |                | •                    |
|                   | 405             | 1.0            | 5.6                    | 9N 1430                  | <u> </u>       |                      |
|                   | 463             | . 1.0          | 17.0                   | 5/N 1430                 |                |                      |
|                   | 532             | 1.0            | 4.6                    | 3/N 944                  |                |                      |
| •                 | 620             | 1.0            | 6.5                    | 5/N 1119                 | 1              | <b>&gt;</b>          |
|                   | 755             | 1.0            | 4.4                    | 3/N 1119 S               |                |                      |
| 71.2.2.3.2        |                 |                |                        | tion Test - X            |                |                      |
|                   | Test<br>No 🕢    |                | sfactory<br>trum Shape | Satisfactory RMS G Level |                | Accumulated Duration |
|                   | NO (4)          |                | YF5(0)                 | 8.0                      |                | 20 SEC.              |
| <b>:</b>          | <del></del>     |                | <del>\</del>           | <del></del>              | <del></del>    | <del></del>          |
|                   |                 |                | +                      | <del></del>              | <del></del>    | <del></del>          |
| •                 |                 |                | <del></del>            |                          |                |                      |
| •                 |                 |                | <u> </u>               |                          |                |                      |
|                   | $\cdot \square$ |                |                        |                          |                |                      |
|                   |                 |                |                        |                          | -              |                      |
|                   |                 | <del>-</del> - | <del></del>            | <del></del>              | +              | <del></del>          |
| •                 |                 |                |                        | ············             | <i></i>        |                      |
|                   |                 |                | •                      |                          |                |                      |
| PREPARED BY DATE  | PERFORME        | D BY C         | MITNESS                | ED FOR NAA . DA          | TE CERTIFIED F | OR McDONNELL, DATE   |
|                   |                 | 9-2-49         | 111                    | No. T. 2/                | V.D.Ma         | vogenis 9/23/54      |
| T.G. Kniffin      | 1114            | July 231       | J.                     | (ANR)                    | 4 VERIFIED B   | 9/2/64               |
| FORM 608-B-39 NEW | 6-63            | •              | •                      |                          | V              |                      |

| COMPONENT NAME _  | THRUST CHAMBER ASSEMBLY - 25# PART NO. \( \begin{array}{l} MAC & 52-52701-265 \\ NAA & 203160-61. \end{array} \) |
|-------------------|--|
| NAME OF TEST      | VIBRATION TEST NO. 203160-51   |
| 7.1.2.2.3.3       | Random Vibration Test - X Axis   |
| •                 | Accelerometer outputs were recorded for analysis at the following elapsed times:                                 |
| •                 | SAMPLE #1 (1 ±0.5 Minute) / min<br>SAMPLE #2 (4 ±0.5 Minutes) / min<br>SAMPLE #3 (7 ±0.5 Minutes) 7.3 min        |
|                   | The elapsed time at test cutoff was 7.66 minutes.  |
|                   | Results of the Analysis:   |
|                   | SAMPLE #1 <u>See 4M20-5-30</u>   |
|                   | X axis shaped 60 to 65 seconds   |
|                   |  |
|                   | SAMPLE #2 _ See 4M &0 - 5-30   |
| •                 | X DXIS Shaped & 40 TO 145 seconds  |
|                   |  |
| . •               | SAMPLE #3 <u>See 4M 20-5-30</u>  |
|                   | X2XIS shaped 440 To 445 seconds  |
|                   |  |
|                   |  |
|                   | ••   |
| PREPARED BY DATE  | PERFORMED BY DATE WITHESSED FOR NAA DATE CERTIFIED FOR MCDONNELL DATE  |
| T.G. Kniffin      | mi fulling of the A la VERIFIED BY USAF DATE   |
| 7-9-64            |  |
| FORM 608-B-39 NEW | 6-63   |

|                   |            | •            |               |                          |               |              |                                  |
|-------------------|------------|--------------|---------------|--------------------------|---------------|--------------|----------------------------------|
| COMPONENT NAME    | THRUST C   | HAMBER A     | SSEMBLY - 2   | PART NO.                 | MAC.          | 52-52        | 701-265                          |
| NAME OF TEST      | VIBRATIO   | •            |               |                          | LNAA.         | 208160       | -61<br>T <u>53</u> OF <u>380</u> |
| 7.1.2.2.3.4       | 7          |              |               | IESI NO                  | 20010         | SHEE         | T 22_0F 260.                     |
| 10102020704       | Resonant   | Survey       | - Y Axis      |                          |               | •            |                                  |
|                   | Freq. cps  | Input<br>g's | Output<br>g's | Identifica (no)          | tion          |              |                                  |
|                   | 265        | 1.0          | 6.0           | 903                      |               | 200          |                                  |
|                   | 310        | 1.0          | 5.0           | 1/19                     |               | 363          |                                  |
|                   |            | 1.6          | 11.5          | 1430                     |               | (F.3)        |                                  |
| •                 | 450        | 1.0          | 16.0          | 1430                     |               | <b>13</b>    |                                  |
| •                 | 630        | 1.0          | . 3. 4        | 944                      |               |              | ••                               |
| •                 | 1300       | 1.0          | 3. 2          | 944                      |               |              |                                  |
| • .               | 1510       | 1.0          | 7.4           | 1127                     |               |              |                                  |
|                   | 1700       | 10           | 3.9           | 1430                     |               | £057         | 1,1                              |
| 7.1:2.2.3.5       | Vibratio   | n Table      | Equalization  | on Test - Y Ax           | <u>is</u>     |              | 123                              |
| 3/4/6             | Test<br>No | Spect        | 10            | Satisfactory RMS G Level |               | tion<br>SFC  | comulated<br>Duration            |
|                   | 4-3        |              | VES_          | 3.5                      | $\frac{1}{2}$ | SEC          | 50 5/7 (G)                       |
|                   | 1          | -            | <del></del>   |                          |               | <del>_</del> | +                                |
| •                 |            |              | =             | $\equiv$                 |               | 主            | 主                                |
|                   |            | •            |               |                          |               |              |                                  |
| PREPARED BY DATE  | PERFORMED  | BY DA        | TE WITHESSED  | OR NAA DATE              | CERTIF        | ED FOR M     | COONNELL, DATE                   |
| T.G. Kniffin      | 100        | Hack         | ell. A.       | Jegarty                  | VERIFIE       | D BY USA     | ens 9/27/64                      |
| 7-9-64            | 1/         | 8/64         | 9/8           | 164 3                    |               |              | G-1.30                           |
| FORM 608-B-39 NEW | 6-63       |              |               | <del></del>              |               |              |                                  |

| COMPONENT NAME     | THRUST CHAMBER ASSEMBLY - 25# PART NO \[ \begin{array}{llllllllllllllllllllllllllllllllllll   |
|--------------------|---|
| 7.1.2.2.3.6        | Random Vibration Test - Y Axis  |
|                    | Accelerometer outputs were recorded for analysis at the following elapsed times:  |
| •                  | SAMPLE #1 (1 ±0.5 Minute) / Minutes |
| 9-4-64             | The elapsed time at test cutoff was 70 minutes.   |
| •                  | Results of the Analysis:  |
| •                  | SAMPLE #1 See 4M20-5-30 Y. Axis   |
| •                  | time  |
| ••                 |   |
|                    | SAMPLE #2 See 4M20-5-30 Y Axis Shepted 240 to 245 second slice  |
|                    | time  |
|                    | SAMPLE #3 See 4M20-5-30 Y Axis  |
|                    | shaped 405 to 410 second slice  |
| •                  |   |
| PREPARED BY DATE   | PERFORMED BY DATE WITNESSED FOR NAA DATE CENTIFIED FOR MCDONNELL DATE   |
| T.G. Kniffin       | Of the State of Luck Sentifico By USAF DATE   |
| ORM 608-B-39 NEW 6 | -63   |

|                        |                |                |  |                        |                  | •          |             |
|------------------------|----------------|----------------|--|------------------------|------------------|------------|-------------|
| COMPONENT NAME.        | THRUST         | CHAMBER AS     | SEMBLY - 25                                      | PART NO                | MAC 52           | -52701-26  | 5           |
| NAME OF TEST           | VIBRATI        | ON-            |  |                        | 0 208160-        | 401 5      | 380         |
| TORNIC OF TEST         |                |                |  | 1ESI N                 | 0 200 12.32      | Shirt 2    | OF 200      |
| 7-1.2.2.3.7            | Resonan        | t Survey       | - Z kais   |                        |                  | M          |             |
| • •                    | Freq.          | Input<br>g's   | Output<br>g's                                    | Identific (no.         |                  | ZNISAW.    |             |
| •                      | 43             | 1.0            | 3.0  | · 1/4 /11              | 9                |            |             |
|                        | 15.2           | 1.0            | 20.0   | 5/11 9                 | 44 9             | _          |             |
|                        | 250            | 1.0            | 3.0  | · 5/N 9                | 44 18/           |            |             |
| •                      | 287            | 1.0            | 2.2  | 3/N 9                  | 03 4             | ×          | ·           |
|                        | 543            | 1.0            | 5.8  | 7N 9                   | 44               | •          | .           |
|                        |                | <del></del>    | <del></del>                                      | <del></del>            | · ·              | i          | •           |
|                        | <del></del>    |                |  | . •                    | •                | •          |             |
| •                      | <del></del>    | ·.             |  |                        |                  |            |             |
| 7.1.2.2.3.8            | Vibrati        | •              |  | n Test - Z A           | xis *            |            | 4           |
|                        | Test<br>No     |                |  | atisfactory MS G Level | Test<br>Duration | Accumul    |             |
| •                      | /              | YE YE          |  | 7.8                    | 55 see           |            | 50C (%)     |
|                        | $\overline{Z}$ | $\overline{z}$ |  | 7                      | 7                | $\sum_{i}$ |             |
|                        | <del></del>    | - <i></i>      |  |                        |                  | =          |             |
| •                      | -+-            | _ ·`           | <del>\                                    </del> | <del></del>            |                  | : -+       | _           |
| •                      | <del></del>    |                | <del>                                     </del> |                        |                  | •          |             |
|                        |                |                |  |                        |                  | • —        |             |
| •                      |                | <u> </u>       | $\mathcal{I}$                                    |                        |                  |            |             |
| •                      | ·              | <del></del>    | <u> </u>   |                        |                  | • •        |             |
|                        | · <del>(</del> | 7 —            |  |                        |                  | • •••••    | 7           |
|                        |                | · ·            |  | . •                    |                  | •          | . '         |
| PREPARED BY DAT        | E PERFORM      | ED BY DAT      | E WITNESSED F                                    |                        | E CERTIFIED      | FOR McDON  | ELL DATE    |
| m 6 V.1661.            | 100            |                | P  | aye w                  | 1/               | wifens     | 1/64        |
| T.G. Kniffin<br>7-9-64 | 12.0           | 4.5 6          | 9-11-  | -64                    | VERIFIED E       | 1: .       | 1.1164 CATE |
| FORM 608-B-39 NEW      |                |                | <u> </u>   | •                      |                  | 69         |             |
| Rev. M. P. H. Wie      | bate_          | 12-16-64       | RET  | Dep # 1                | 7-5-64           |            |             |
| 208                    |                |                |  |                        |                  | R-15019    | -2          |

| COMPONENT NAME _    | THEUST CHAMBER ASSEMBLY _ 25# PART NO. MAC _52-52701-265   |
|---------------------|--|
| NAME OF TEST        | VIBRATION TEST NO 203160-61.  TEST NO 203160-56 OF 380   |
| 7.1.2.2.3.9         | . Random Vibration Test-Z Axis   |
| •                   | Acceleration outputs were recorded for analysis at the following elapsed times:  |
|                     | SAMPLE #1 (1 ±0.5 Minute) / Minutes SAMPLE #2 (4 ±0.5 Minutes) 4 Minutes SAMPLE #3 (7 ±0.5 Minutes) 4.75 Minutes   |
| •                   | The elapsed time at test cutoff was 7./ minutes. 9-5-64  |
|                     | Results of the Analysis:   |
|                     | SAMPLE #1 See 4M20-5-30 7 AxIs Shaped 66 to 65 second Slice time (2)   |
| •                   | SAMPLE #2 See 4M20-5-30 7 Axis   |
| •                   | time 'B)   |
|                     |  |
|                     | SAMPLE #3 Sec 41120-5-30 7 Axis  |
|                     | time & 405 to 410 second slice   |
|                     |  |
| •                   |  |
| T.G. Kniffin 7-9-64 | PERFORMED BY OFFE WITNESSED FOR NAA DATE CERTIFIED FOR MCDONNELL DATE  ON DO TO THE WITNESSED FOR NAA  OATE CERTIFIED FOR MCDONNELL DATE  VERIFIED BY USAF  OATE  OATE |
| ORM 608-B-39 NEW    | 6-63   |
| •                   | range in the second of the second of the second of the second of the second of the second of the second of the   |

| COMPONENT NAM |   | LNAA 200100-01  |
|---------------|---|---|
| NAME OF TEST_ | VIBRATION TEST NO   | 203160-401<br>SHEET 57 OF 380   |
| 7.1.2.2.3.10  | Propellant Valve Proof Pressure and Leakage Proof Pressure  Pressure (500 +10)  Time Duration (3 minimum)  Leakage Voltage (26±0.5)  Time Duration (500 +10)  Time Duration (5 minimum)  Leakage Rate  Proof Pressure    500   10   10   10   10   10   10   10 | ge test (reference  Fuel Valve  Soo paig  minutes  26 9 VDC  500 paig  minutes  ZE20 SCC He |
| •             | (2.23 maximum) min  | min   |
|               | Inspection Remarks NONE   |   |
| ·             |   |   |
| • .           |   | •   |
| •             |   |   |
|               | •   |   |
|               |   |   |
| PREPARED BY   | 1/10/14 Free 9/6/64 Solmon @  | VERIFIED BY USAF DATE   |
|               | 7/0/07  | Star Mance 1/s/11   |
| FORM 608-B-39 | NEW 6-63  | •   |

|   |  | •                                     | ·               |  |
|---|--|---------------------------------------|-----------------|--|
| COMPONENT NAME                          | THRUST CHAMBER ASS                                       | EMBLY - 25# P                         |                 | 2-52701-265<br>08160-61  |
| NAME OF TEST                            | VIRRATION  | Т                                     | EST NO 208160-  | 401<br>SHEET 53 OF 380   |
| 7.1.2.2.3.11                            | Thrust Chamber Proof paragraph 6.2)                      | Pressure and La                       | eakage test (re | ference  |
| 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | Proof Pressure   | 1st Application                       | a 2nd Anni      | ication (1)  |
|   | Pressure<br>(392 ±10)                                    | 392 psig                              | 39Z             | gestion and search   |
| :                                       | Time Duration (3 ±0.25)                                  | 3.0 minus                             | tes 📆 🔼         | _minutes 🛞 💙   |
|   | Voltage (12±2.0)   | 12.0_VDC                              | 17.0            | _VDC 💮 😽   |
| •                                       | Inspection Remarks                                       | NENF (3)                              | · <del></del>   |  |
|   |  |                                       | •               | ·  |
|   | ·  |                                       |                 |  |
|   |  |                                       |                 |  |
|   |  | <del></del>                           |                 |  |
| •                                       |  | · · · · · · · · · · · · · · · · · · · |                 |  |
| :                                       | •  |                                       |                 |  |
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| _                                       |  |                                       |                 | -  |
| -                                       |  |                                       |                 |  |
| · <b>_</b>                              |  |                                       |                 |  |
| PREPARED BY OF                          | ATE PERFORMED BY DATE  14. Tree- 1/6/  1/6/1/1/1/1/1/6/4 | WITNESSED FOR NAA                     | 99/1/1/1        | FOR McDONNELL DATE  11315 111 7/22/1  BY USAF DATE  CHECKER 1/28/C |
| FORM 608-B-39 NE                        | W 6-63   |                                       |                 | 16   |

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| COMPONENT NAM   | E THRUST CHAMBER ASSEMBLY - 25# PART NO. MAC  |
|-----------------|---|
| NAME OF TEST    | VIBRATION   |
| 7.1.2.2.3.12    | Propellant Valve Electrical Resistance test (reference paragraph 6.3)   |
| *               | Environmental Temperature 70 (70+10F)   |
|                 | Resistance A - B  |
|                 | Oxidizer Valve (3) 4/. 4 ohms (Acceptable per Figure 9) yes or no Ve 5  |
|                 | Fuel Valve (Acceptable per Figure 9, yes or no Yes)   |
| •               | Resistance C - D (1.0 maximum)  |
|                 | Oxidizer Valve05 ohms   |
| •               | Fuel Valve  |
| •               | Inspection Remarks / UNC (%)  |
|                 |   |
| ,               |   |
| •               |   |
|                 |   |
|                 |   |
|                 |   |
| E. Adams 4/10/  | PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR McDONNELL DATE  1. D. Warsen 1/2 / Cy  VERIFIED BY USAF DATE  7-8-69  1. D. Warsen 1/2 / Cy  VERIFIED BY USAF DATE  1. D. Warsen 1/2 / Cy  VERIFIED BY USAF DATE  1. D. Warsen 1/2 / Cy  VERIFIED BY USAF DATE |
| ORM 608-B-39 NO | EW 6-63   |

| COMPONENT NAME   | THRUST CHAMBER ASSI                  | embly - 25                              | # PART N                                  | O MAC 52                                | 2-52701-26<br>08160-61 | 5         |
|------------------|--------------------------------------|---|---|---|------------------------|-----------|
| NAME OF TEST     | VIERATION                            |   | ,   | LNAA                                    |                        | )F_380    |
| 7.1.2.2.3.13     | Propollant Valve Dic                 | electric S                              | trength test                              | (reference                              | e para. 6              | .4)       |
|                  |                                      | Oxidizer<br>Voltage<br>Volts<br>500 ±10 | Valve<br>Current<br>Microamps<br>500 max. | Fuel Val<br>Voltago<br>Volts<br>500 ±10 |                        | 5         |
| •                | A to Ground                          | 500                                     | 78  | 500 6                                   | 20                     |           |
|                  | C to Ground                          |   | 58 (%)                                    | 500                                     | 60                     | (a)       |
|                  | A to C                               | 500                                     | الان الان الان الان الان الان الان الان   | 500 6                                   | J 25                   |           |
| •                | Inspection Remarks                   |   | Sone @                                    |   |                        |           |
|                  |                                      | •                                       |   |   |                        | -         |
| -                |                                      |   |   | •                                       |                        | · ·       |
| -                |                                      |   |   |   | •                      | · .       |
| •                |                                      |   | . •                                       |   |                        |           |
|                  |                                      |   | •   |   |                        |           |
| E. Adams         | PERFORMED BY DATE  //// /// // -8-64 | WITNESSED                               | TOR NAA DAY                               | VERIFIED F                              | or McDonnel            | DATE DATE |
| TOWN GOO-D-39 NO | -w 0-03                              | 4                                       |   |   | <i>"</i> .             |           |

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| COMPONENT NAME  | THRUST CHAMBER ASSEMBLY - 25# PART NO MAC 52-52701-265                   |
|-----------------|--|
| Oom Orgin Hame  | NAA 208160-61  |
| NAME OF TEST    | VIBRATION TEST NO. 208160-101 OF 380                                     |
|                 |  |
| 7.1.2.2.3.14    | Propellant Valve Functional test (reference paragraph 6.5)               |
| •               | Oxidizer Valve Fuel Valve  |
| . •             | ∧  |
| •               | Response Time  |
|                 | Ambient Temperature 70 P 70 P  |
|                 | (70 ±10) Energizing Voltage 26 VDC (2) 26 VDC                            |
|                 | Energizing Voltage 26 VDC (26 +0.5)                                      |
|                 | Inlet Pressure 300 psig 300 psig   |
|                 | (200 ±10 for H=171 dep)  |
| •               | Opening Time .0037 seconds   |
| * · · ·         | (U.UO) maximum) (1.23)   |
|                 | Inlet Pressure ZeRo psig ZeRo psig                                       |
| •               | (zero for "drop-out")  Closing Time  (20) 20035 seconds                  |
|                 |  |
|                 | (0.0035 maximum)   |
|                 | A  |
| •               | Low Voltage Operation  |
| •               | Ambient Temperature 70 P 70 P  |
|                 | Ambient Temperature 70 P 70 P (70 +10)                                   |
|                 | 198 - 198  |
| c               | Inlet Pressure 300 psig 300 psig (300+10 for "pull-im")                  |
|                 | Opening Voltage 8 VDC 7 VDC  |
| •               | (16 maximum)   |
|                 | Inlet Pressure (%) Zero psig Zero psig                                   |
|                 | (zero for "drop-out")  |
|                 | Closing Voltage (70) 2.0 VDC (3) 1.2 VDC                                 |
|                 | (1.0 minimum)  |
|                 |  |
|                 | Inspection Remarks Nove (5)  |
|                 |  |
|                 |  |
| PREPARED BY DA  | TE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR MCDONNELL DATE |
|                 | 7.3 Pake 1 K 60 9 1. D. Marigenio 9/2/84                                 |
| B. Adams        | VERIFIED BY WSAF , /DATE   |
| 779 4/19        | 4 7-8-64 HUNGUAM & CONTROL PATE  |
| ORM 608-B-39 NE |  |

#### ROCKETDYNE

DEVELOPMENT LABORATORY TEST REPORT

| PR!      | LPARE    | D BY       |  |     |          |                |  | EWR I        | NO.  |            |              |             |                |                | F4-            | ILITY  |  | ·  | ·                 |                     | ONE            |  | PATE   |                  |             |
|----------|----------|------------|--|-----|----------|----------------|--|--------------|--|------------|--------------|-------------|----------------|----------------|----------------|--|--|--|-------------------|---------------------|----------------|--|--|------------------|-------------|
|          | Po       |            |  |     |          |                |  |              | 396  |            |              |             |                |                | EM             |  |  |  |                   |                     |                | 1  |  | , ,              |             |
| PAI      |          | 70         |  |     | <u> </u> |                |  | PART         | NO.  | 20         | 216          | 0-61        | ı              |                | EAN V          | - 14   | TEST   | D  |                   | 20                  | 061            | 19.  | <u>-ც-</u>                                       | 64               |             |
|          |          | 5#         | TCA  | Un  | it       | #1             | ءِ ا   | N\           | 405  | 200<br>82° | 33<br>310    | <b></b> 0 : | ı              |                | Va]            | 770  | T  | ros  | 5T 1              | (מבי)<br>רי         | rat:           | ion  | Pr   | ope.             | Lla         |
|          | 1        | <u> </u>   |  | T   |          | " ·            | T '-   | <del>/</del> | T .  | T          | <del>7</del> | T           | Т              | <u> </u>       | Val            | lve  | rui  | T C  | One               | 1                   | Г              | Γ  | т—   | γ                | г           |
|          | ļ        |            | <u>.                                    </u> |     |          | ļ              | ļ  | <u> </u>     | 1  | ļ          | <u> </u>     |             | ļ.,            | L              |                |  |  | <u> </u>   | L_                |                     | <u> </u>       |  |  |                  |             |
|          |          |            |  |     |          |                |  |              |  |            | OX:          | IDIZ        | ER             | VAI            | VE             |  |  |  |                   |                     |                |  |  | ļ ·              |             |
|          |          |            |  |     |          | P/N            | 40   | 7754         | 9  |            |              |             |                |                |                | -  | /NI  | 919  | 255               | 0                   |                |  |  |                  |             |
|          | $\vdash$ | _          | <del> </del>                                 |     |          | -              | -  | -            | <del> </del>                                     |            | ╁╌           | ╁           | ├              | <del> </del> - | -              |  | // N   | 717  | 100               | 7                   | -              | <del> </del>                                     | ├—   | ├                | -           |
|          |          |            | <u> </u>                                     |     |          | ļ              | ļ  | ┞            | <u> </u>   | L          | $\bot$       | •           | •              | •              | •              | •  | •  | •  | •                 | •                   | •              | '  | •  | •                | •           |
| CU       | RRE      | M          | ΓRA  | CE  |          |                |  |              |  |            | L            |             | And Sh         |                | g-sector       |  |  |  | F. CON            | -                   | e active       | Manny lan  |  | ed to the        |             |
| (0       | PEN      | TiviC      | ጥፕ   | ME) |          |                |  |              |  |            |              | ľ           | ,              |                |                |  |  |  |                   |                     |                |  |  | - ,-             |             |
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| Но       | riz      | ont        | al   | =   | 1        | ms/            | cm   |              |  |            |              |             |                |                |                |  |  | ,  | e<br>e            | على .<br>فيرمد فحار | A CONTRACT     | ••   |  |                  |             |
| Ve.      | rti      | cal        |  | =   | 20       | mv             | /cm  |              |  |            |              |             |                |                |                |  |  | 7  |                   |                     | * *            |  | •  |                  | 38          |
|          |          |            |  |     |          |                |  | 1            |  |            | †            |             |                |                |                |  |  |  |                   |                     |                |  | -  |                  |             |
|          |          |            |  |     |          |                | <del> </del>                                     | ├            | <del> </del>                                     | -          | +            | No.         |                |                |                |  | . 10   | 11   | **                |                     |                |  |  |                  | <b>§</b>    |
| Re       | ui       | rem        | ent  | =   | 0.       | <u> bo6</u>    | 5 s  | ec/          | max  | <u> </u>   | $\perp$      |             |                |                | A James        | *  |  | ,  |                   |                     |                |  |  |                  | 3           |
| Ac       | tua      | L          |  | =   | 0.       | b03            | 7 s  | ec ·         |  |            |              |             | مستر<br>مسارعه |                |                | ar en Sagbayelle   |  | wante of   |                   | عبث شد              |                |  | والمعادد   | . بديا تقويد الأ | 3           |
|          |          |            |  |     |          | - 42           |  |              |  |            | 十            |             |                |                |                | P. Commercial Commerci |  |  | 45                |                     |                |  |  |                  |             |
| -        |          |            | _  |     |          | <del> </del> - | ├  | $\vdash$     | ├  | -          | -            | +           | <del> </del>   | <del> </del>   | <del> </del>   | <del>                                     </del>   | <del>                                     </del> | <del>                                     </del>   | <del> </del> -    | <del> </del>        | <u> </u>       | <del>                                     </del> | <del>                                     </del> | <del> </del>     | <del></del> |
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| _        |          |            |  |     |          | L              | <u> </u>   | <u>L</u> .   | <u> </u>   |            | 1_           | <u> </u>    |                |                |                |  |  |  |                   |                     | L_             |  |  |                  |             |
| 70       | JTA      | GE '       | rra  | CE  |          |                |  |              |  |            |              | ı           | 1              | l              | ı              | ì  |  | İ  |                   | ĺ                   |                |  |  |                  |             |
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| Но       | riz      | <b>bnt</b> | al   | =   | 0.       | 5 m            | s/c  | h            |  |            |              | ì           |                |                |                |  |  |  |                   |                     |                |  |  |                  |             |
| 7.       | ti       | 22         |  | =   | 10       | v/             |  |              |  |            | Τ            |             |                |                |                |  |  | ,  | . a.              |                     |                |  |  |                  | 1           |
| -        | 01       | aı         |  | =   | 10       | V/             | Cm.  | -            |  | _          | +            | Ł           |                |                |                |  | 4.   | W 25 45 8  | ne<br>Harris      |                     | •              |  |  |                  | -           |
| _        |          |            |  |     |          |                |  |              |  | ļ          | $\perp$      |             |                |                |                |  |  |  | T.                |                     |                |  |  |                  | i dina      |
| Re       | ui:      | rem        | ent  | =   | 0.0      | 003            | b s  | ec/          | max  |            |              | ŀ           |                |                |                |  |  |  | 5                 |                     |                |  |  |                  | 3           |
|          | tua.     |            |  | =   |          |                | 5 s  | l .          |  |            | T            |             |                |                |                |  |  |  | er<br>J           |                     |                |  |  |                  |             |
| ~        | Jua.     | <u> </u>   |  | _   | 0.1      | 102            | D S  | BC           | -  |            | +            |             |                | . Lealine      | and the second | yeş oluğunun   |  |  |                   |                     |                |  |  |                  | 1           |
|          |          | ļ          | _  |     |          | <u> </u>       |  | _            |  |            | $\downarrow$ |             | o Proces       | مواديد مشدد    | د اد محدود     | مسع ماساد  | موردون   | عدر سند  |                   | مد وسائد و          | وروا كالمواددة | عدداد الماسان                                    |  | and the same of  |             |
|          |          | l.         | l  |     |          | L              | L  | L            |  | L          | 1            |             |                |                |                | L  |  | ı_   |                   |                     | 1              | ·  | 1  | 1                | 1           |
|          |          |            |  | *   |          |                | 1  |              | I  |            | Γ            | [           |                |                |                | •  |  |  |                   |                     |                |  |  |                  |             |
|          |          |            |  |     |          |                |  |              |  |            |              | 1           | 1              |                | 1              |  |  |  |                   |                     |                |  |  |                  |             |
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|          |          |            |  |     |          |                |  |              |  |            |              |             |                |                |                |  |  |  |                   |                     |                |  |  |                  |             |
|          |          |            |  |     |          |                |  |              |  |            |              |             |                |                |                |  |  |  |                   |                     |                |  |  |                  |             |
|          |          |            |  |     |          |                |  |              |  |            |              |             |                |                |                |  |  |  |                   |                     |                |  |  |                  |             |
|          |          |            |  |     |          |                |  |              |  |            |              |             |                |                |                |  |  |  |                   |                     |                |  |  |                  |             |
|          |          |            |  |     |          |                |  |              |  |            |              |             |                |                |                |  |  |  |                   |                     |                |  |  |                  |             |
|          |          |            |  |     |          |                |  |              |  |            |              |             |                |                |                |  |  |  |                   |                     |                |  |  |                  |             |
|          |          |            |  |     |          |                |  |              |  |            |              |             |                |                |                |  |  |  |                   |                     |                |  |  |                  |             |

#### ROCKETDYNE

DEVELOPMENT LABORATORY TEST REPORT

PREPARED BY FACILITY PHONE 595396 PART NO. 208160-61 ENV.LAB. F.Pope 2061 9-8-64 TYPE OF TEST POST VIBRATION PROPELLANT S/N 4058233 SE7 25# TCA Unit #1 VALVE FUNCTIONAL HUEL VALVE P/N 407560 CURRENT TRACE (OPENING TIME) Horizontal Vertical = 20mv/cm Requirement - 0.0065 sec/max 0.0039 sec Actual VOLTAGE TRACE (CLOSING TIME) Horizontal 0.0035 sec/max Actua] 0.0028 sec

Form 600\_17\_67 New 10\_63 216

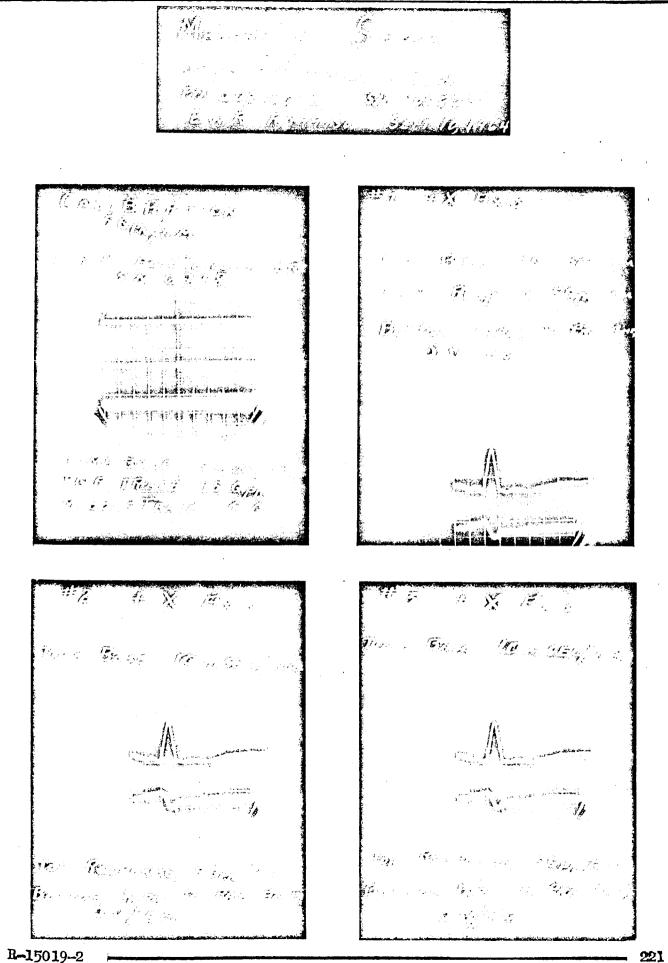
| COMPONENT NAME   | THRUST CHAMBER ASSEMBLY - 25# PART NO. \ MAC   |  |  |  |  |  |  |  |  |  |  |
|------------------|--|--|--|--|--|--|--|--|--|--|--|
| NAME OF TEST     | PART NO. { NAA 208160-61   MECHANICAL SHOCK   TEST NO.208160-401   SHEET 62 OF 380   |  |  |  |  |  |  |  |  |  |  |
| Reference:       | MAC SCD 52-52701, Revision F, paragraph 6.2.3.16   |  |  |  |  |  |  |  |  |  |  |
| 7.1.3            | Shock - TCA #1   |  |  |  |  |  |  |  |  |  |  |
| 7.1.3.1          | Test Procedure   |  |  |  |  |  |  |  |  |  |  |
| 7.1.3.1.1        | Place the TCA into shipping container in accordance with RAO616-008 and install in shock testing facility.  The direction of shock input shall be along the + X Axis of the TCA (see Figure 7.)  |  |  |  |  |  |  |  |  |  |  |
| 7.1.3.1.2        | Apply a half sine wave shock of 15 ±1.5 g magnitude and 11 ±1.0 milliseconds duration to the TCA. The shock magnitude and duration shall be monitored by an oscilloscope and the trace recorded with a Polaroid camera. Inspect the TCA for visible evidence of damage following the application of the shock. In the event of a structural failure see paragraph 3.6. |  |  |  |  |  |  |  |  |  |  |
| 7.1.3.1.3        | Repeat paragraph 7.1.3.1.2 two times for a total of three shocks.  |  |  |  |  |  |  |  |  |  |  |
| 7.1.3.1.4        | Repeat paragraphs 7.1.3.1.1 through 7.1.3.1.3 for the - X Axis of the TCA.   |  |  |  |  |  |  |  |  |  |  |
| 7.1.3.1.5        | Repeat paragraphs 7.1.3.1.1 through 7.1.3.1.4 for the Y Axis of the TCA.   |  |  |  |  |  |  |  |  |  |  |
| 7.1.3.1.6        | Repeat paragraphs 7.1.3.1.1 through 7.1.3.1.4 for the Z Axis of the TCA.   |  |  |  |  |  |  |  |  |  |  |
| 7.1.3.1.7        | Perform Propellant Valve Proof Pressure and Leakage per paragraph 6.1.   |  |  |  |  |  |  |  |  |  |  |
| 7.1.3.1.8        | Perform Thrust Chamber Proof Pressure and Leakage per paragraph 6.2.   |  |  |  |  |  |  |  |  |  |  |
|                  |  |  |  |  |  |  |  |  |  |  |  |
| PREPARED BY:     | DATE APPROVED FOR NAA: DATE APPROVED FOR McDONNELL: DATE   |  |  |  |  |  |  |  |  |  |  |
| CHECKED BY:      | DATE / Leice 4-13-64   |  |  |  |  |  |  |  |  |  |  |
| FORM 608-8-38 NE |  |  |  |  |  |  |  |  |  |  |  |

| COMPONENT NAME | THRUST CHAMBER ASSEMBLY - 25#           | PART NO. { MAC 52-52701-265 NAA 208160-61             |
|----------------|---|---|
| NAME OF TEST   | MECHANICAL SHOCK                        | TEST NO. 208160-61<br>TEST NO. 208160-SHEET 63 OF 380 |
| 7.1.3.1.9      | Perform Propellant Valve Electrica 6.3. | l Resistance per paragraph                            |
| 7.1.3.1.10     | Perform Propellant Valve Dielectri      | c Strength per paragraph 6.4.                         |
| 7.1.3.1.11     | Perform Propellant Valve Functiona      | l per paragraph 6.5.                                  |

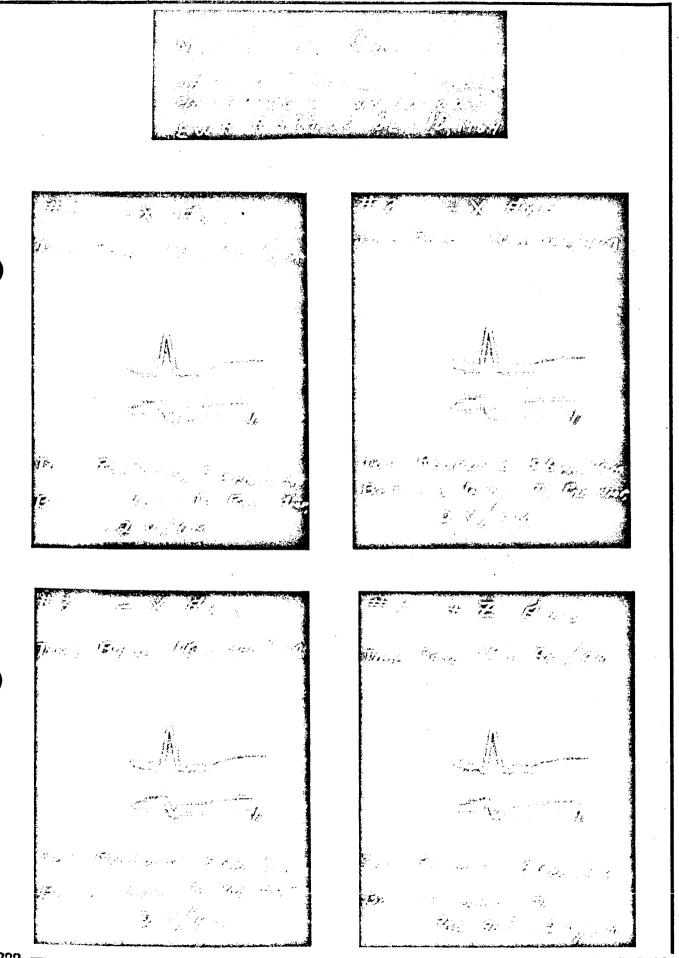
DATE 4/10/64 DATE PREPARED BY: E. Adams APPROVED FOR NAA: APPROVED FOR MCDONNELL: Faide 4-13-64 CHECKED BY: 117 Marsha 110-14 FORM 608-B-38 NEW 6-63

| er .                                    | NICE CULLINATE ACCE      |                              | (MAC_52-52701-265  |
|---|--------------------------|------------------------------|--|
|   | RUST CHAMBER ASSE        | I PULL                       | T NO ( NAA 208160-61   |
| NAME OF TESTNEC                         | HANICAL SHOCK            | TES                          | T NO. 203160 SMEET 64 OF 380   |
| 7.1.3.2 Test                            | Data - TCA #1            |                              | •  |
| 7.1.3.2.1 Comp                          | onent Identificat        | ion                          |  |
| Comp                                    | onent Name               | TCA                          | •  |
| McDo                                    | nnell Part No.           | 52-52701-26                  |  |
| Rock                                    | etdyne Part No.          | 208160-61                    |  |
| Comp                                    | onent Serial No.         | 4058233                      |  |
| 7.1.3.2.2 Shoc                          | k Test (reference        | paragraph 7.1.3.             | .1)  |
| •                                       | Magnitude<br>15 ±1.5 g's | Duration<br>11 ±1.0 millisec | conds .  |
|   | + X )                    | xis                          |  |
| (%)                                     | 14.5                     | 10 MS                        |  |
|   | 14.                      | 10°M5                        |  |
| ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) | 14,                      | 10M5                         | <b>3</b>   |
| V                                       | - X                      | ris                          |  |
|   | 14.                      | 10 MS                        |  |
| × 3                                     | 14.8                     | 10 MS                        |  |
| <b>₩</b>                                | 14.8                     | 10 A15                       | - Grad   |
| <b>V</b>                                | *                        |                              |  |
|   |                          |                              |  |
| PREPARED BY DATE PER E. Adams 4/10/14   | G-10-64                  | WITNESSED FOR NAA            | DATE CERTIFIED FOR McDONNELL, DATE  1.D. Morrosomo 9/2/3/4  10 VERIFIED BY USAF DATE  64 Afric Maner 9/10/5/ |
| FORM 608-B-39 NEW 6-6                   | 3                        |                              |  |

|                          | E THRUST CHAMBER ASSE         | /RTV - 25# - 25#                            | MAC 52-52701-265  |        |  |  |  |  |  |
|--------------------------|-------------------------------|---|---|--------|--|--|--|--|--|
| COMPONENT NAM            | <del></del>                   |   | NU NAA 208160-61  |        |  |  |  |  |  |
| NAME OF TEST             | MECHANICAL SHOCK              | فينتا تفسير ويردان والمناز وتوريس والتواوين | ST NO 208160-SHEET 65 OF  | 380    |  |  |  |  |  |
| 7.1.3.2.2<br>(continued) | Shock Test (reference         | paragraph 7.1.3                             | .1)   | ·      |  |  |  |  |  |
| Magnitude<br>15 ±1.5 g's | Duration 11 ±1.0 milliseconds | Magnitude<br>15 ±1.5 g's                    | Duration 11 ±1.0 milliseconds   |        |  |  |  |  |  |
| +                        | Y Axis                        | + 2   | Axis  |        |  |  |  |  |  |
| <b>國力工</b>               | 0'10 ms                       | 3 15  | 10 ms   |        |  |  |  |  |  |
| 15                       | 200 mg                        | ® 14.5                                      | 3 10 ms   |        |  |  |  |  |  |
| (6)/5 N                  | EVO 215                       | 3)15  | @ 107MS   | .      |  |  |  |  |  |
|                          | Y Axis                        | - 2 Axis                                    |   |        |  |  |  |  |  |
| <b>3</b> 14.5            | @ 10 ms                       | 15  | 10 ms   |        |  |  |  |  |  |
| <b>3</b> 15              | (3) 10 ms                     | <b>3</b> 15                                 | (3) 10 ms   |        |  |  |  |  |  |
| B 15.                    | 10 ms                         | 15  | (3) 10 ms.  |        |  |  |  |  |  |
| ·                        | Inspection Remarks            | None  | <b>2</b>  |        |  |  |  |  |  |
|                          |                               |   |   |        |  |  |  |  |  |
| ÷                        |                               |   |   | -      |  |  |  |  |  |
|                          |                               |   |   | _      |  |  |  |  |  |
| ·                        |                               |   |   | ·      |  |  |  |  |  |
| ·                        |                               |   |   |        |  |  |  |  |  |
| E. Adams                 | 9-11-44                       | HITNESSED FOR NAA                           | DATE CERTIFIED FOR MCDONNEL  A. W. J.D. Marsons 91  VERIFIED BY WAF  Atime Man 1/10 | L DATE |  |  |  |  |  |
| Et 1/1                   | 0/61 P.C. Hoch<br>9-11-44     |   | - 1/1   |        |  |  |  |  |  |



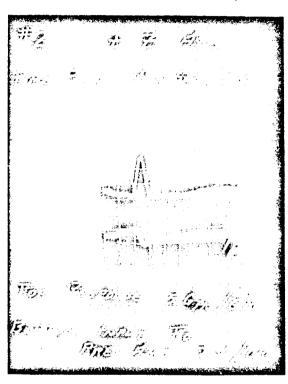
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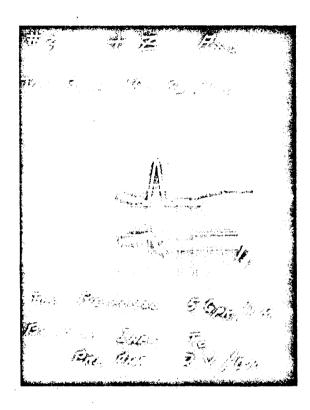


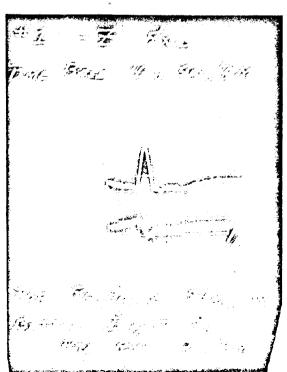
#### ROCKETDYNE

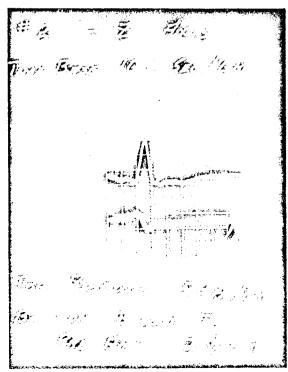
A DIVISION OF NORTH AMERICAN AVIATION IN







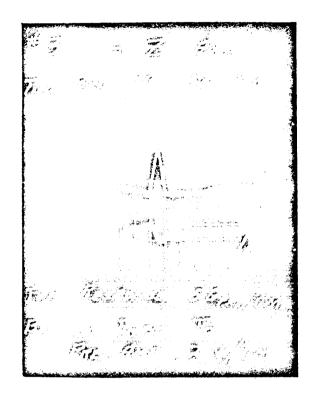


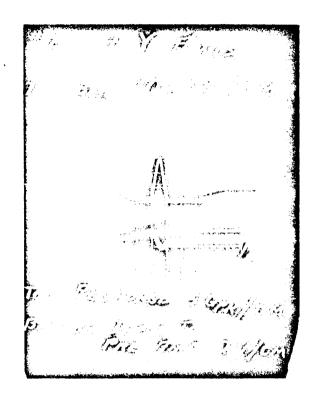


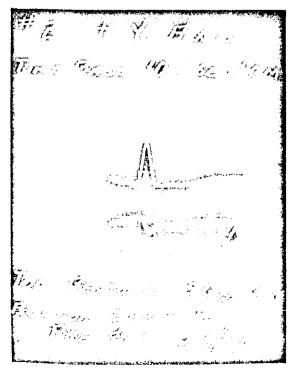
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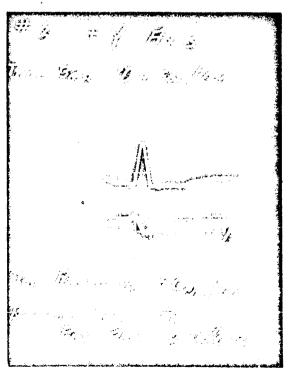
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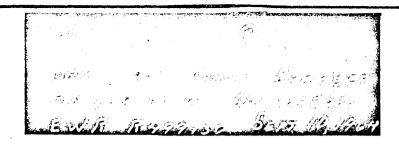


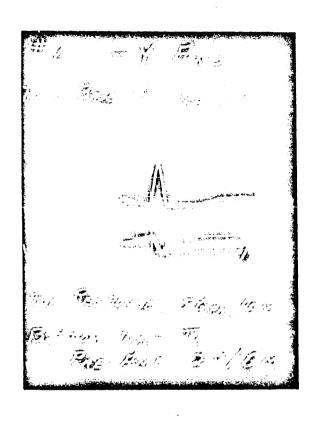


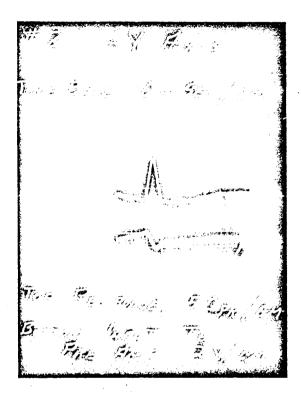


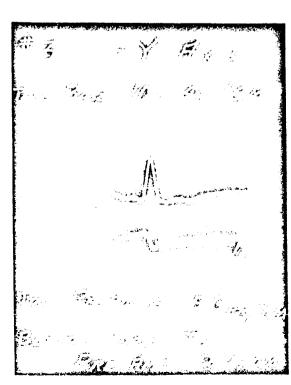
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#### ROCKETDYNE









A DIVISION OF NORTH AMERICAN AVIATION, INC.

# DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT NAM | E THRUST CHAMBER ASSEMBLY - 25# PART NO. \[ \frac{MAC}{NAA} \frac{52-52701-265}{208160-61} \]   |
|---------------|---|
| NAME OF TEST  | MECHANICAL SHOCK TEST NO. 208160-SHEET 660F 380   |
| 7.1.3.2.3     | Propellant Valve Proof Pressure and Leakage test (reference paragraph 6.1.)  Oxidiser Valve Fuel Valve  Proof Pressure  (500 +10)  Time Duration  3 minutes  3 minutes  |
|               | (3 minimum)  Leakage  Voltage (26 <sup>+</sup> 0.5)  Inlet Pressure (500 ±10)  Time Duration (5 minimum)  Time Duration (5 minimum)   |
|               | Leakage Rate (2.23 maximum)  Inspection Remarks    None   Company |
|               |   |
| PREPARED BY   | DATE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR McDONNELL, DATE   |
| E. Adams 4/10 | O 9/ h.D Mouragenia 9/22/   |

5/21/4 FORM 608-B-39 NEW 6-63

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| COMPONENT NAME    | THRUST CHAMBER ASSI                 |                     | NO 203160-45HEET 67 OF 380  |
|-------------------|-------------------------------------|---------------------|---|
| 7.1.3.2.4         | Thrust Chamber Proof paragraph 6.2) | Pressure and Leakag | ge test (reference  |
|                   | Proof Pressure                      | 1st Application     | 2nd Application   |
|                   | Pressure<br>(392 <u>+</u> 10)       | 392 mi              | 392 psig  |
|                   | Time Duration (3 ±0.25)             | 3 minut             |   |
| •                 | Voltage (12-2.0)                    | VDC                 |   |
|                   | Inspection Remarks:                 | No Evide            | NCC OF LOADOGE  |
| • • .             |                                     |                     |   |
|                   |                                     |                     | •   |
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| COMPONENT NAME | THRUST CHAMBER ASSEMBLY - 25# PART NO \[ \lambda \frac{\text{MAC} 52-52701-265}{\text{NAA} 208160-61} \] |
|----------------|--|
| NAME OF TEST   | MECHANICAL SHOCK TEST NO 208160-SHEET 68 OF 380  |
| 7.1.3.2.5      | Propollant Valve Electrical Resistance test (reference paragraph 6.3)                                    |
|                | Environmental Temperature 70 (70 ±10F)   |
|                | Resistance A - B   |
|                | Oxidizer Valve (1.5 ohms (Acceptable per Firmre 9, yes or no Yes (1.5).                                  |
|                | Fuel Valve Ohms (Acceptable per Figure 9., yes or no Yes (A).  |
|                | Resistance C - D (1.0 maximum)   |
| •              | Oxidizer Valve 3 .05 ohms  |
| •              | Fuel Valve (3)ohms   |
|                | Inspection Remarks Nove  |
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FORM 608-B-39 NEW 6-03

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|-------------------------|---|---|--|
| COMPONENT NA            | AME THRUST CHAMBER ASS                  | EMBLY - 25# PART N  | MAC 52-52701-:265  |
| •                       | MECHANICAL SUCCE                        |   | (NAA 208160-61   |
| NAME OF TEST.           | TEXTALIZATE SHOOK                       | TEST N  | 10 208160-6AEET 69 OF 380  |
| 7.1.3.2.6               | Propellant Valve Di                     | electric Strength tes   | t (reference paragraph 6.4   |
| 13.23                   |   | Oxidizer Valve Voltage Current Volts Microamps 500 ±10 500 max. | Fuel Valve Voltage Current Volts Microamps 500 ±10 500 max.  |
|                         | A to Ground                             | 500 49 (  | 500 (1) 40 (2)   |
|                         | C to Ground                             | 500(1)21  | 500 (021 (0)   |
|                         | A to C                                  | 1500 16   | 500 15 3   |
| •                       | (Inspection Remarks)                    | Nove (  | · 3  |
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| COMPONENT NAM | 101 50 200   |
|---------------|--|
| NAME OF TEST  | MECHANICAL SHOCK TEST NO. 208160-SHEET 70 OF 380   |
| 7.1.3.2.7     | Propallant Valve Functional test (reference paragraph 6.5)   |
|               | Oxidizer Valve Fuel Valve  |
|               | Response Time  |
| <b>*</b>      |  |
|               | Ambient Temperature 70 P 70 P  |
|               | (70 ±10)   |
| !             | Energizing Voltage 26 VDC 26 VDC   |
| •             | $(26 \pm 0.5)$ $(378)$   |
| <b>Q</b>      | Inlet Pressure 300 psig 300 psig   |
|               | Opening Time (300 ±10 for "pull-in") (300 ±10 for "pul |
| •             | oponing -  |
| •             | (0.0065 maximum)  Thet Pressure  Zeko psig  Zeko psig  |
|               |  |
|               | (zero for "drop-out") (70), 0025 seconds (70) seconds  |
|               | Closing time   |
|               | (Q.0035 maximum)   |
|               | Low Voltage Operation  |
|               | TO P TO P  |
|               | Ambient lemperature (%)  |
|               | (70 ±10) Thet Pressure (27) 300 paig (20)  |
|               | Inlet Pressure (3) 336 paig 300 paig(3)  |
|               | (:300+10 for "pull-in" 7.8 VDC 7.0 VDC   |
|               | Opening volume   |
|               | (16 maximum) Inlet Pressure  A Zero psig Zero psig   |
| '             | (zero for "drop-out")  |
|               | Closing Voltage (20) 2 VDC 1.1 VDC   |
|               | (1.0 minimum)  |
| ·             |  |
|               | Inspection Remarks Nove  |
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#### ROCKETDYNE

#### DEVELOPMENT LABORATORY TEST REPORT

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| Ver<br>Req       | rtica]<br>uiren | nent.  | =            | 10       | v/<br>003  | cm<br>5 s    | ec/      | /max     | -<br>-<br>-<br>-       |  | Light of the second of the sec |                       |  |  |  | · · · · · · · · · · · · · · · · · · ·  | 新期 建水油 化二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基二甲基二甲基甲基二甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基二  |  | Service of   |  |                     |                                       |  |
| Ver<br>Req       | rtica]<br>uiren | nent.  | =            | 10       | v/<br>003  | cm<br>5 s    | ec/      | 'max     | -                      |  | Carlotte Carlotte  |                       |  |  | The second secon | 等 " " " " " " " " " " " " " " " " " " "  | 新期 建水油 化二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基二甲基二甲基甲基二甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基二  |  | Secretary of the secret |  |                     |                                       | The state of the s |
| Ver<br>Req       | rtica]<br>uiren | nent.  | =            | 10       | v/<br>003  | cm<br>5 s    | ec/      | max      | -<br>-<br>-<br>-<br>-  | Andread Control of the Control of th | Control of the contro |                       |  |  |  | 等 " " " " " " " " " " " " " " " " " " "  | 新期 建水油 化二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基二甲基二甲基甲基二甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基二   |  | Control E  | Canada de la constanta de la c |                     |                                       |  |
| Ver<br>Req       | rtica]<br>uiren | nent.  | =            | 10       | v/<br>003  | cm<br>5 s    | ec/      | /max     | -                      | Andreas Control of the control of th | The second secon |                       |  | The state of the s |  | 等 " " " " " " " " " " " " " " " " " " "  | 新期 建水油 化二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基二甲基二甲基甲基二甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基二   |  | in the second se |  |                     |                                       |  |
| Ver<br>Req       | rtica]<br>uiren | nent.  | =            | 10       | v/<br>003  | cm<br>5 s    | ec/      | max .    | -                      | Making the second secon | of the second of |                       |  | The state of the s | The second secon | 等 " " " " " " " " " " " " " " " " " " "  | 新期 建水油 化二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基二甲基二甲基甲基二甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基二   |  | County of the Co | in market  |                     |                                       |  |
| Ver<br>Req       | rtica]<br>uiren | nent.  | =            | 10       | v/<br>003  | cm<br>5 s    | ec/      | max      | -                      |  |  |                       |  |  |  | 等 " " " " " " " " " " " " " " " " " " "  | 新期 建水油 化二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基二甲基二甲基甲基二甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基二   |  | e de la constante de la consta |  |                     |                                       |  |
| Ver<br>Req       | rtica]<br>uiren | nent.  | =            | 10       | v/<br>003  | cm<br>5 s    | ec/      | 'max     | -                      | Andrews Control of Con | See A. Se |                       |  |  |  | 等 " " " " " " " " " " " " " " " " " " "  | 新期 建水油 化二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基二甲基二甲基甲基二甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基二   |  |  | in opening   |                     |                                       |  |
| Ver<br>Req       | rtica]<br>uiren | nent.  | =            | 10       | v/<br>003  | cm<br>5 s    | ec/      | /max     | -                      | Andrew Control of the |  |                       |  |  |  | 等 " " " " " " " " " " " " " " " " " " "  | 新期 建水油 化二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基二甲基二甲基甲基二甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基二   |  | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  |  |                     |                                       |  |
| Ver<br>Req       | rtica]<br>uiren | nent.  | =            | 10       | v/<br>003  | cm<br>5 s    | ec/      | 'max     | -                      | habitation of the company of the com | Control of the contro |                       |  |  |  | 等 " " " " " " " " " " " " " " " " " " "  | 新期 建水油 化二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基二甲基二甲基甲基二甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基二   |  |  |  |                     |                                       |  |
| Ver<br>Req       | rtica]<br>uiren | nent.  | =            | 10       | v/<br>003  | cm<br>5 s    | ec/      | /max     | -                      | And the second s |  |                       |  |  |  | 等 " " " " " " " " " " " " " " " " " " "  | 新期 建水油 化二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基二甲基二甲基甲基二甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基二   |  |  |  |                     |                                       |  |
| Ver<br>Req       | rtica]<br>uiren | nent.  | =            | 10       | v/<br>003  | cm<br>5 s    | ec/      | max      |                        | Andrew Control of the | Control of the contro |                       |  |  |  | 等 " " " " " " " " " " " " " " " " " " "  | 新期 建水油 化二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基二甲基二甲基甲基二甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基二   |  |  |  |                     |                                       |  |
| Ver<br>Req       | rtica]<br>uiren | nent.  | =            | 10       | v/<br>003  | cm<br>5 s    | ec/      | /max     | -                      |  | Line in the second seco |                       |  |  |  | 等 " " " " " " " " " " " " " " " " " " "  | 新期 建水油 化二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基乙基二甲基甲基二甲基二甲基甲基二甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基甲基二甲基二   |  |  |  |                     |                                       |  |

#### ROCKETDYNE

#### DEVELOPMENT LABORATORY TEST REPORT

PAGE LAB TEST NO. . PREPARED BY EWR NO. FACILITY PHONE 595396 ENV.TEST 2061 F. Pope 9-10-64 208160-61 TYPE OF TEST Post Shock Propellant PART NO. PART SE7 25# TCA Unit #1 S/N 4058233 Valve Functional FUEL VALVE P/N 407560 CURRENT TRACE (OPENING TIME) = 1 ms/cmHorizbntal Vertical 20mv/cm Requirement = 0.0065 sec/mac 0.004D sec Actual VOLTAGE TRACE (closing time) Horizontal 0.5 ms/cm Vertikal 10v/cm 0.0065 sec/max Requirement = 0.002B sec Actual

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Form 600\_17\_67 New 10\_63 2

| COMPONENT NAME | THRUST CHAMBER ASSEMBLY - 25#  | PART NO 5 MAC 52-52701-265          |  |  |  |  |  |  |  |  |  |
|----------------|--|-------------------------------------|--|--|--|--|--|--|--|--|--|
| COMPONENT NAME | DAT DUTY CYCLE TO FAILURE  | NAA 208160-6:                       |  |  |  |  |  |  |  |  |  |
| NAME OF TEST   | DAI DOI! CICLE TO FRILURE  | TEST NO. 208160-401 SHEET 71 OF 380 |  |  |  |  |  |  |  |  |  |
| Reference:     | MAC SCID ED EDEDO D  |                                     |  |  |  |  |  |  |  |  |  |
|                | MAC SCD 52-52701, Revision F, para   |                                     |  |  |  |  |  |  |  |  |  |
| 7.1.4          | DAT Duty Cycle to Failure - TCA #1   |                                     |  |  |  |  |  |  |  |  |  |
| 7.1.4.1        | Test Procedure   |                                     |  |  |  |  |  |  |  |  |  |
| 7.1.4.1.1      | Parform Cape Cycle Firing Test per paragraph 6.7.  |                                     |  |  |  |  |  |  |  |  |  |
| 7.1.4.1.1.1    | Make a one second firing followed by another one second firing ten minutes later.                              |                                     |  |  |  |  |  |  |  |  |  |
| 7.1.4.1.1.2    | Wait five minutes and make a one second firing followed by another one second firing ten minutes later.        |                                     |  |  |  |  |  |  |  |  |  |
| 7.1.4.1.1.3    | Repeat paragraph 7.1.4.1.1.2.  |                                     |  |  |  |  |  |  |  |  |  |
| 7.1.4.1.2      | Wait for TCA skin temperature to 1 (70 ±20 F).   | return to am lent temperature       |  |  |  |  |  |  |  |  |  |
| J              | Perform Duty Cycle Firing Test per<br>The TCA shall be fired until catas<br>Catastrophic failure is defined in | trophic failurt occurs.             |  |  |  |  |  |  |  |  |  |
| 7.1.4.1.4      |  | ·                                   |  |  |  |  |  |  |  |  |  |
| 7.1.4.1.5      | Reduce data per SEM 4388-4040.   |                                     |  |  |  |  |  |  |  |  |  |
| 7.1.4.1.5.1    | The results of significant data shoto the following:   | mall include but not be limited     |  |  |  |  |  |  |  |  |  |
| 7.1.4.1.5.1.1  | Graphical presentation of temperat thermocouple locations.   | ture Versus time for all TCA        |  |  |  |  |  |  |  |  |  |
| 7.1.4.1.5.1.2  | Graphical presentation of total in   | pulse versus signal width:          |  |  |  |  |  |  |  |  |  |
| 7.1.4.1.5.1.3  | Graphical presentation of mean spewidth:   | ecific impulse versus signal        |  |  |  |  |  |  |  |  |  |
|                | Failure analysis.  |                                     |  |  |  |  |  |  |  |  |  |
| PREPARED BY:   | DATE APPROVED FOR NAA: DATE  | APPROVED FOR MCDONNELL: DATE        |  |  |  |  |  |  |  |  |  |
|                | 29/44 /110   |                                     |  |  |  |  |  |  |  |  |  |
| CHECAED BY     | DATE / 10,10 9-19-   |                                     |  |  |  |  |  |  |  |  |  |

R-15019-2

FORM 608-B-38 NEW 6-63

ROCKETDYNE

A DIVISION OF NORTH AMERICAN AVIATION ING

| COMPONENT NAM        | THRUST CHAMBER ASSEMBLY - 25# PART NO. [MAC_  | · 52-52701-265<br>208160-61  |
|----------------------|---|--|
| NAME OF TEST.        | ΙΝΛΛ  | 401<br>-SHEET 72 OF 380  |
| 7.1.4.2              | Test Data - TCA No. 1   | SHEET TO OF  |
| 7.1.4.2.1            | Component Identification  |  |
|                      | Component Name $SE-7$ $\frac{A^{N_0}}{330}$   |  |
|                      |   |  |
| ·                    |   |  |
|                      | Rocketdyne Part No. 208160-61   |  |
| •                    | Component Serial No. 4058233  |  |
|                      | Accumulated Acceptance Test Firing Time, seconds  | J.O SEC.   |
|                      | Pre-Test  | Post Test  |
|                      | Throat Diameter, inches (Average of four measurements)  | 3575   |
|                      | Nozzle Exit Diameter, inches  | 2.230  |
| 7.14.2.2             | Propellant Samples  |  |
| •                    | Tetroxic  |  |
| •                    | Sample Date   | 1 10000  |
|                      | Sample Batch Number   |  |
|                      | Sample Temperature, F   | 7/   |
| •                    | Sample Specific Gravity   | 5.870 Mg   |
|                      | Met Mil Spec. Requirements (Yes or No)  |  |
| PREPARED BY B. Adams | DATE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED  10/64 - Standard JANA VERIFIED  VERIFIED | FOR MCDONNELL CATE  ON THE PROPERTY OF THE PRO |
| FORM 608-B-30 K      | NEW A-62  | 14   |

| •                       | THRUST CHAMBER ASSEMBLY T DUTY CYCLE TO FAILURE | LNAA_                      | 52-52701-265<br>208160-61<br>50-601<br>SHEET 72-20F 380 |
|-------------------------|---|----------------------------|---|
| 7.14.2.3                |   | nce paragraph 7.1.41       |   |
|                         | Test Cell Location · Test Cell Number           | 29-1 39-1                  | 3)  |
|                         | Test Number Test Date                           | <u>_089</u>                | n de e  |
|                         |   | Pulse Duration             | Time between  |
|                         | 1st Pulse                                       | (sec)<br>(1.000 ±.020 sec) | Pulses, (minutes)                                       |
|                         | 2nd Pulse                                       | 1.015                      | (10)  |
| •                       | 3rd Pulse 4th Pulse                             | 1.015                      |   |
|                         | 5th Pulse<br>6th Pulse                          | 1.015                      | <u>5</u> (5)<br><u>10</u> (10)                          |
|                         | Accumulated Firing Time, s                      |                            |   |
|                         | * DSC. Time lines unren                         | duble                      | •   |
| PREPARED BY D. Cole 1/2 | DATE PERFORMED BY DATE WITNES                   | In I de la                 | SO BY USAF DATE   |
| FORM 608-B-39 N         | IEW 6-63  | <u> </u>                   |   |

12-15019-2

235

|                             | (MAC 52-52701-265  |
|-----------------------------|--|
| COMPONENT I                 | ME THRUST CHAMBER ASSEMBLY - $25\%$ PART NO. $\frac{MAC}{NAA}$ 208160-61   |
|                             | DAT DUTY CYCLE TO FAILURE TEST NO. 202160- SHEET 73 OF 380   |
| era in the least of receive |  |
| 1.1.4.2.4                   | AT Duty Cycle Data (reference paragraph 7.1.4.1)   |
|                             | est Cell Location CTL III.   |
| •                           | est Cell Number 39-5   |
| •                           | Cest Number 090  |
|                             |  |
| •                           | Test Date 10-5-69  |
| · ·                         | NOTE: All data corrected to Standard Vacuum conditions.  |
| • .                         | TOTAL MADE CONTECTED TO STAILED TO THE STAIL T |
| •                           |  |
|                             |  |
|                             |  |
|                             |  |
| •                           |  |
|                             |  |
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| •                           |  |
| •                           |  |
|                             |  |
|                             |  |
|                             |  |
|                             |  |
| BOCOAUTO OF                 | DATE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR MCDONNELL DA   |
| PREPARED DY                 | DATE PERFORMED BY  |
| J. Gang                     | DATE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR MCDONNELL DATE CERTIFIED FOR MCDONNELL DATE CERTIFIED BY WAR DATE CERTIFIED BY WAR DATE CERTIFIED BY WAR DATE CERTIFIED BY WAR DATE OF THE |
| FORM 608-B-                 | 10/2/64  |

| COMPONENT NAMETHRUST_CHANBER ASSEMBLY - 25#  NAME OF TESTDAT_DUTY_CYCLE_TO_FAILURE | PART NO ${M \choose N}$ | AC 52-527 |             | <del></del> |
|--|-------------------------|-----------|-------------|-------------|
| Sequence Number_/  | 10.22                   |           |             |             |
| Pulse Number   | .2                      | 16        | 36          | 1           |
| Signal Width, msec   | 22.6                    | 25.9      | 30.6        | 1           |
| Start Time, msec (25 max.)   | 13,9                    | 8.9       | 15.8        | 1           |
| Environmental Pressure, psia   | 1011                    | ,011      | .011        | 1           |
| Environmental Temperature, or  | 70                      | 70        | 70          | 1           |
| Oxidizer Inlet Temperature, OF   | 70.                     | 70        | 70.         | 1           |
| Fuel Inlet Temperature, or   | 70                      | 70        | 70          | 1           |
| Oxidizer Inlet Pressure, psia  | 292                     | 292       | 292         | 1           |
| Fuel Inlet Pressure, psia  | 272                     | 292       | 292         | 1           |
| Total Oxidizer Flow, lbs   | *                       | * *       | *           | 1           |
| Total Fuel Flow, 1bs   | *                       | *         | *           | 1           |
| Mean Mixture Ratio, o/f  | +                       | *         | *           | 1           |
| Pulse Total Impulse, 1b-sec  | . 5409                  | .5801     | .6925       | 1           |
| Mean Specific Impulse, sec   | *                       | *         | *           | 1           |
| Shutdown Impulse, 1b-sec (.260 max) ***  | 11915                   | 1900      | 1932        | 1           |
| Cut-Off Time, msec   | 12.4                    | 16.6      | 13.4        | 1           |
| Oxidizer Valve Voltage, volts  | 26                      | 26        | 26          | 1 :         |
| Fuel Valve Voltage, volts  | 26                      | 26        | 26          | ]           |
| Oxidizer Valve Current, amps   | .636                    | .636      | .636        | ]           |
| Fuel Valve Current, amps   | .623                    | ,623      | .623        | ]           |
| Electrical Power, watts  | 32.7                    | 32.7      | 32.7        |             |
| * Flows Unreadable - Instrumentation Problem                                       | 5                       |           |             | $\sqrt{N}$  |
| ** Ref: ECN NA-SE6-289Rl   | ort of the              | ^         | 2           | <u>り</u>    |
| Prepared by: Checked by:   | Appr                    | oved for  | hay pa:     |             |
| 2 De house   | 11                      | ITHE      | iw pa.      |             |
| FORM 608-B-37 NEW 6-63   | 0                       | A         | <del></del> | *******     |

| •           | Sequence !humber                      | Site   | Standard   |
|-------------|---------------------------------------|--------|------------|
|             | Pulse Number /                        | Data   | Vacuum     |
|             | Firing Duration, sec                  | 4.2    |            |
| •           | Accumulated Firing Time, sec          | 21.0   | •          |
|             | Data Slice Number                     |        |            |
|             | Time of Data Slice, sec               | 4.0    |            |
|             | Environmental Pressure, psia          | .011   | . 0        |
|             | Environmental Temperature, P          | 91 (VA | c.chamber) |
|             | Oxidizer Temperature, OF              | 84     | 70         |
|             | Fuel Temperature, OF                  | 84     | 70         |
|             | Oxidizer Inlet Pressure, psia         | 290.7  | 292        |
|             | Fuel Inlet Pressure, psia             | 290.5  | 292        |
|             | Oxidizer Flowrate, lbs/sec            | 0460   | .0462      |
| •           | Fuel Flowrate, lbs/sec                | 19354  | 10357      |
|             | Mixture Ratio, o/f (1.30+6%)          | 1.30   | 1.30       |
|             | Thrust, 1bs (23.0+5%)                 | 23.9   | 24.0       |
| •           | Specific Impulse (272 min.)           | 293    | 294        |
| •           | Start Time, msec (25 max)             | 15.    |            |
|             | Shutdown Impulse, 1b-sec (.260 max)** | 1680   |            |
|             | Oxidizer Valve Voltage, volts         | 28.9   |            |
|             | Fuel Valve Voltage, volts             | 29.1   |            |
| •           | Oxidizer Valve Current, amps          | 1664   |            |
| •           | Fuel Valve Current, amps              | 1644   |            |
|             | Electrical Power, watte               | 37.9   | •          |
|             |                                       |        |            |
| **          | ** Ref: ECN NA-SE6-289RL              |        | ••         |
| Prepared by | Chocked by:                           |        |            |

| •            |   | •   | •                                      |             |
|--------------|---|---|--|-------------|
|              | NAME THRUST CHAIRER ASSEMBLY - 25# T DAT DUTY GYCLE TO FAILURE  | _ PART NO. { MAC.   | 52-52701-6<br>208160-61                | <u> 265</u> |
|              | TOTAL TO FAILURE  | _ TEST NO. 20316  | O-SHEET                                | _OF         |
| •            | Sequence Number 3 Pulse Number /  | Site<br>Data  | Standard                               |             |
| •            | Firing Duration, sec  Accumulated Firing Time, sec  Data Slice Number  Time of Data Slice, sec  Environmental Pressure, psia  Environmental Temperature, of  Oxidizer Temperature, of  Fuel Temperature, of  Oxidizer Inlet Pressure, psia  Fuel Inlet Pressure, psia  Oxidizer Flowrate, lbs/sec  Fuel Flowrate, lbs/sec  Mixture Ratio, o/f (1.30+6%)  Thrust, lbs (23.0+5%)  Specific Impulse  Start Time, msec (25 max) | 84<br>290.7<br>287.9<br>.0462<br>.0344<br>_134<br>_23.6<br>_293 | Vacuum  O  C. Chumbe  70  70  292  292 | ·           |
| **           | Shutdown Impulse, 1b-sec (.260 max) oxidizer Valve Voltage, volts  Fuel Valve Voltage, volts  Oxidizer Valve Current, amps  Fuel Valve Current, amps  Electrical Power, watts  Ref: ECN NA-SE6-289R1  | 16.5<br>.2048<br>28.9<br>29.2<br>.661<br>.450<br>38.1           |  | J. S.       |
| * •          | DON NA-DEO-ZOYKI  |   | •                                      |             |
| Prepared by: | Checked by  | Approvad  | FENNAA by                              |             |

FORM 608-B-37 NEW 6-63 R-15019-2

| COMPONENT NAME THRUST CHAMBER ASSETBLY - 25# PART NO. NAA 208160         |       |             |            |   |  |
|--|-------|-------------|------------|---|--|
| NAME OF TEST DAT DUTY CYCLE TO FAILURE                                   |       |             |            |   |  |
| Sequence Number 4  |       | •           | -          |   |  |
| Pulse Number   | 3     | 9           | 27         |   |  |
| Signal Width, msec   | 12.8  | 19.6        | 17.4       | · |  |
| Start Time, msec (25 max.)   | 17.1  | 17.1        | 15.8       |   |  |
| Environmental Pressure, psia   | .011  | .011        | .011       |   |  |
| Environmental Temperature, OF  | 70    | 70          | 70         |   |  |
| Oxidizer Inlet Temperature, OF   | 70    | 70          | 70         |   |  |
| Fuel Inlet Temperature, OF   | 70    | 70.         | 70         |   |  |
| Oxidizer Inlet Pressure, psia  | 292   | 292         | 292        | 7 |  |
| Fuel Inlet Pressure, psia  | 792   | 252         | 292        | • |  |
| Total Oxidizer Flow, 1bs   | *     | *           | *-         |   |  |
| Total Fuel Flow, 1bs   | *     | ¥Ł.         | *          |   |  |
| Mean Mixture Ratio, o/f  | *     | *           | *          |   |  |
| Pulse Total Impulse, 1b-sec  | 32/2  | .3956       | ,3089      |   |  |
| Mean Specific Impulse, sec   | *     | <b>,*</b> . | <b>4</b> 4 |   |  |
| Shutdown Impulse, 1b-sec (.260 max) **                                   | 1791  | 2091        | 1772       |   |  |
| Cut-Off Time, msec   | .15.4 | 16.1        | 13.5       |   |  |
| Oxidizer Valve Voltage, volts  | 76    | 26          | 26         | : |  |
| Fuel Valve Voltage, voltage  | 26    | 26          | 26         |   |  |
| Oxidizer Valve Current, amps   | .636  | .636        | .636       |   |  |
| Fuel Valve Current, amps   | .623  | 623         | .623       |   |  |
| Electrical Power, watts  | 3 2.7 | 32.7        | 32.7       |   |  |
| * Flows Unreadable - Instrumentation Problems , ** Ref: ECN-NA-SE6-289R1 |       |             |            |   |  |
| Prepared by: Checked by:   | Appr  | greet Box   | MAA by:    |   |  |

A.

| ME OF TEST | DAT DUTY CYCLE TO FAILURE             | ( NAA<br>TEST NO. <u>20816</u> | 208160-61<br>101<br>0-speet_of |
|------------|---------------------------------------|--------------------------------|--------------------------------|
| •          | Sequence Number 5 Pulse Number 3      | Site<br>Data                   | Standard<br>Vacuum             |
|            | Firing Duration, sec                  | .702                           |                                |
|            | Accumulated Firing Time, sec          | 26.5                           | •                              |
|            | Data Slice Number                     | <u> </u>                       |                                |
|            | Time of Data Slice, sec               |                                | •                              |
|            | Environmental Pressure, psia          | -45-                           | 0                              |
|            | Environmental Temperature, P          | 011                            | c.chAmber)                     |
|            | Oxidizer Temperature, OF              | · <del>-</del>                 |                                |
|            | Fuel Temperature, OF                  | 86                             | 70                             |
|            | Oxidizer Inlet Pressure, psia         | . 86                           | 70                             |
|            | Fuel Inlet Pressure, psia             | <u> 295.5</u>                  | 292                            |
| •          | Oxidizer Flowrate, lbs/sec            | 270.3                          | 292                            |
| •          | · ·                                   | .0470                          | _0467                          |
| •          | Fuel Flowrate, 1bs/sec                | 1353                           | .0357                          |
|            | Mixture Ratio, o/f (1.30+6%)          | _ <i>_1,33</i> _               | 1.3/                           |
|            | Thrust, 1bs (23.0+5%)                 | 23.8                           | 23.8                           |
|            | Specific Impulse (172 in.)            | 289                            | 289                            |
|            | Start Time, msec (25 max)             | 14                             | •                              |
| ٠          | Shutdown Impulse, 1b-sec (.260 max) * | * 12/86                        |                                |
|            | Oxidizer Valve Voltage, volts         | 29.0                           |                                |
| ·<br>_     | Fuel Valve Voltage, volts             | 29.2                           |                                |
|            | Oxidizer Valve Current, amps          | . 661                          |                                |
|            | Fuel Valve Current, amps              | 647                            | •                              |
|            | Electrical Power, watte               | 38.1                           |                                |
|            |                                       | •                              |                                |
| <b>*</b> * | Ref: ECN NA-SE6-289R1                 |                                |                                |
| *          | •                                     | •                              |                                |
|            |                                       |                                |                                |
| pared by   | Checked by:                           | Approfed                       | fr. Nayby:                     |

| COMPONENT NAME THRUST CHANBER ASSETBLY - 25# PART NO { MAC 52-52701-265 NAA 208160 |            |          |       |          |  |  |
|--|------------|----------|-------|----------|--|--|
| NAME OF TEST DAT DUTY CYCLE TO FAILURE T   | EST NO 200 | 160-SHEE | T0F   | _        |  |  |
| Sequence Number 6  |            |          |       |          |  |  |
| Pulse Number   | 2          | 15       | 27    |          |  |  |
| Signal Width, msec   | 24.3       | 23.9     | 23.3  | ·        |  |  |
| Start Time, msec (25 max.)   | 14.4       | 14.6     | 10.9  |          |  |  |
| Environmental Pressure, psia   | 011        | .011     | .011  |          |  |  |
| Environmental Temperature, OF  | 70         | 20       | 70    |          |  |  |
| Oxidizer Inlet Temperature, OF   | 70         | 70       | 70    |          |  |  |
| Fuel Inlet Temperature, F  | 70         | 70       | 70    |          |  |  |
| Oxidizer Inlet Pressure, psia  | 292        | 292      | 292   | 7        |  |  |
| Fuel Inlet Pressure, psia  | 292        | 292      | 292   | ٥        |  |  |
| Total Oxidizer Flow, 1ba   | *          | *        | ×     |          |  |  |
| Total Fuel Flow, 1bs   | *          | -74      | *     |          |  |  |
| Mean Mixture Ratio, o/f  | *          | +        | *     |          |  |  |
| Pulse Total Impulse, 1b-sec  | .5189      | .4958    | 5065  | .        |  |  |
| Mean Specific Impulse, sec   | +          | *        | z/c   |          |  |  |
| Shutdown Impulse, 1b-sec (.260 max) **   | .2057      | 2038     | ,2181 |          |  |  |
| Cut-Off Time, msec   | .15.1      | 16.5     | 15.1  |          |  |  |
| Oxidizer Valve Voltage, volts  | 26         | 26       | 26    |          |  |  |
| Fuel Valve Voltage, volts  | 26         | 26       | 26    |          |  |  |
| Oxidizer Valve Current, amps   | .636       | .636     | .636  |          |  |  |
| Fuel Valve Current, amps   | 623        | 1623     | 623   |          |  |  |
| Electrical Power, watts  | 32.7       | 32.7     | 32.7  |          |  |  |
| * Flows Unreadable - Instrumentation Problems                                      |            |          | _     | -        |  |  |
| x ** Ref: ECN NA-SE6-289RL   |            |          |       |          |  |  |
| Prepared by:  12/ Dohims  My frestert  | Appr       | X Co.    | Depr  | <u> </u> |  |  |
| FORM 608-B-37 NEW 6-63   |            |          |       |          |  |  |

| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# PART NO. MAC 52-52701-265 |             |           |         |              |  |
|--|-------------|-----------|---------|--------------|--|
| NAME OF TEST DAT DUTY CYCLE TO FATHERE                                 | TEST NO. 20 | 3160-SHEE | T0F_    |              |  |
| Sequence Number 7  |             |           |         |              |  |
| Pulse Number   | 15          | 101       |         | 7            |  |
| Signal Width, msec   | 36.8        | 36.9      | •       | 1.           |  |
| Start Time, msec (25 max.)   | 14.4        | 10.6      |         | 1            |  |
| Environmental Pressure, psia   | .011.       | .011      |         |              |  |
| Environmental Temperature, or  | 70          | 70        |         | 7            |  |
| Oxidizer Inlet Temperature, or   | 70          | 70        |         | 7            |  |
| Fuel Inlet Temperature, P  | 70          | 70        |         |              |  |
| Oxidizer Inlet Pressure, psia  | 292         | 292       | 1       |              |  |
| Fuel Inlet Pressure, psia  | 292         | 292       | 2       | 1            |  |
| Total Oxidizer Flow, 1bs   | *           | *         |         | 7            |  |
| Total Fuel Flow, lbs   | *           | *-        |         | 7            |  |
| Mean Mixture Ratio, o/f  | *           | *         |         | 7            |  |
| Pulse Total Impulse, 1b-sec  | 8179        | 8421      |         |              |  |
| Mean Specific Impulse, sec   | *           | *         | -       | 7            |  |
| Shutdown Impulse, 1b-sec (.260 max) **                                 | 2015        | .2273     |         | 7            |  |
| Cut-Off Time, msec   | .16.6       | 15.0      |         | 7 .          |  |
| Oxidizer Valve Voltage, volts  | 26          | 26        |         | 7            |  |
| Fuel Valve Voltage, volts  | 26          | 26        |         |              |  |
| Oxidizer Valve Current, ampa   | ,636        | .636      |         |              |  |
| Fuel Valve Current, amps   | 623         | ,623      |         |              |  |
| Electrical Power, watts  | 32.7        | 32.7      |         |              |  |
| * Flows Unreadable - Instrumentation Problems                          |             |           |         |              |  |
| ** Ref: ECN NA-SE6-289Rl   |             |           |         | <i>ک</i> , ا |  |
| Prepared by:  Checked by:  Checked by:  FORM 608-B-37 NEW 6-63         | Appr        | JA FU     | in Sopi |              |  |

| COMPONENT N | DAT DUTY CYCLE TO FAILURE   | . PART NO. { MAC.<br>NAA<br>. TEST NO. 20816                                    | 52-52701-265<br>208160-61<br>0-5HZETOF.                                |  |
|-------------|---|---|--|--|
|             | Sequence Number 3  Pulse Number 3  Firing Duration, sec  Accumulated Firing Time, sec  Data Slice Number  Time of Data Slice, sec  Environmental Pressure, psia  Environmental Temperature, or  Oxidizer Temperature, or  Fuel Temperature, or  Oxidizer Inlet Pressure, psia  Oxidizer Flowrate, lbs/sec  Fuel Flowrate, lbs/sec  Mixture Ratio, o/f (1.30+6%)  Thrust, lbs (23.0+5%)  Specific Impulse (25 max)  Shutdown Impulse, lb-sec (.260 max)*  Oxidizer Valve Voltage, volts  Fuel Valve Voltage, volts  Oxidizer Valve Current, amps  Fuel Valve Current, amps | Site Data .691 36.0 4 .65 .011 85 (v) 87 290.7 290.3 .0474 .0355 .1.34 23.6 285 | Standard Vacuum  0 9e.chamber) 70 70 292 292 10477 10358 1.33 23.8 286 |  |
|             | Electrical Power, watts  Ref: ECN NA-SE6-289Rl  | 38.3  |  |  |

Prepared by

Checked by:

| COMPONENT NAME THRUST CHAMBER ASSETBLY - 25# PART NO.   MAC 52-52701-265 |                            |            |  |     |    |  |
|--|----------------------------|------------|--|-----|----|--|
| NAME OF TEST DAT DUTY CYCLE TO FAILURE                                   | ۲ کا<br>TEST NO. <u>20</u> | 8160-SHE   | ET   | OF  |    |  |
| Sequence Number 9  | •                          |            |  |     |    |  |
| Pulse Number   | 2                          | 4          | Ι  | •   | 1  |  |
| Signal Width, msec   | 32,2                       | 32.0       |  |     | 1. |  |
| Start Time, msec (25 max.)   | 14.1                       | 13.7       | -  | · . | ł  |  |
| Environmental Pressure, psia   | .011                       | .011       |  | · · | l  |  |
| Environmental Temperature, OF  | 70                         | 70         | <del>                                     </del> |     |    |  |
| Oxidizer Inlet Temperature, oF   | 70                         | 70.        |  |     |    |  |
| Fuel Inlet Temperature, or   | 70                         | 70         |  |     |    |  |
| Oxidizer Inlet Pressure, psia  | 292                        | 292        | 7  |     |    |  |
| Fuel Inlet Pressure, psia  | 292                        | 292        | 0  |     |    |  |
| Total Oxidizer Flow, 1bs   | *                          | *          |  |     | l  |  |
| Total Fuel Flow, lbs   | *                          | *          | <u> </u>   |     |    |  |
| Mean Mixture Ratio, o/f  | *                          | *          |  |     |    |  |
| Pulse Total Impulse, 1b-sec  | 7222                       | ,7201      |  |     | İ  |  |
| Mean Specific Impulse, sec   | *                          | A.         |  |     |    |  |
| Shutdown Impulse, 1b-sec (.260 max) **                                   | 12050                      | ,2034      |  |     |    |  |
| Cut-Off Time, msec   | .12.2                      | 16.2       |  |     |    |  |
| Oxidizer Valve Voltage, volts  | 26                         | 26         |  |     |    |  |
| Fuel Valve Voltage, volts  | 26                         | 26         |  |     |    |  |
| Oxidizer Valve Current, amps   | .636                       | ,636       |  |     |    |  |
| Fuel Valve Current, amps   | ,623                       | .623       |  | 7   |    |  |
| Electrical Power, watts  | 32.7                       | 32.7       |  |     |    |  |
| * Flows Unreadable - Instrumentation Problem * .** Ref: ECN NA-SE6-289R1 |                            |            |  | ٠,  |    |  |
| Prepared by:  19/ De lune Will Mustice  FORM 608-8-37 NEW 6-63           | Appr                       | 1 X (D)    | NAA by   | ; : |    |  |
| · · · · · · · · · · · · · · · · · · ·                                    |                            | <b>J</b> . |  |     |    |  |

COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# PART NO. DAT DUTY CYCLE TO FAILURE NAME OF TEST \_\_ TEST NO. 208160-SHEET Sequence Number 10 Pulse Humber 3 9 544 Signal Width, msec\_ 58.5 58.8 58.4 Start Time, msec (25 max.) 12.9 12.6 /3. 2 Environmental Pressure, psia 011 .011 011 Environmental Temperature, F 70 20 70 Oxidizer Inlet Temperature, F 70 70 70 Fuel Inlet Temperature, F 70 70 20 Oxidizer Inlet Pressure, psia 292 292 292 Fuel Inlet Pressure, psia 292 792 292 Total Oxidizer Flow, 1bs\_ × X × \* Total Fuel Flow, lbs \* × \* Mean Mixture Ratio, o/f \* × Pulse Total Impulse, 1b-sec 1.4303 1.4361 1.3983 \* \* Mean Specific Impulse, sec Shutdown Impulse, 1b-sec (.260 max) \*\* 2093 2/08 1931 Cut-Off Time, msec .16.4 14.4 16.3 Oxidizer Valve Voltage, volts 26 26 26 Fuel Valve Voltage, volts 26 26 26 Oxidizer Valve Current, amps 636 636 636 Fuel Valve Current, amps\_ 623 1,23 623 Electrical Power, watts 32.7 32.7 ミン・フ

\* Flows Unreadable - Instrumentation Problems
\*\* Ref: NA-SE6-289Rl

| Frepared by:           | Checked     | by t | 1. B. A. |   | Appr | drea [ | for NAA (by: | _ |
|------------------------|-------------|------|----------|---|------|--------|--------------|---|
| 12/ Oxlanson           | //w         | Min  | tak      | 1 |      | ЦX     | William      |   |
| FORM 608-8-37 NEW 6-63 | <del></del> | 7    | 7        | · |      |        |              | _ |

| COMPONENT NAME THRUST CHAMBER ASSETBLY - 25# PART NO. { MAC 52-52701-265 |             |            |               |  |  |
|--|-------------|------------|---------------|--|--|
| NAME OF TEST DAT DUTY CYCLE TO FAILURE                                   | TEST NO. 20 |            |               |  |  |
| Sequence Number //   |             |            |               |  |  |
| Pulse Humber   | 15          | T T        | , 7           |  |  |
| Signal Width, msec   | 35.3        |            | <del></del> . |  |  |
| Start Time, msec (25 max.)   | 14.2        |            |               |  |  |
| Environmental Pressure, psia   | .011        |            |               |  |  |
| Environmental Temperature, OF  | 70          |            |               |  |  |
| Oxidizer Inlet Temperature, OF   | 20          |            |               |  |  |
| Fuel Inlet Temperature, or   | 70          |            |               |  |  |
| Oxidizer Inlet Pressure, psia  | 292         | 7          |               |  |  |
| Fuel Inlet Pressure, psia  | 292         | -          | •             |  |  |
| Total Oxidizer Flow, 1bs   | *           |            |               |  |  |
| Total Fuel Flow, 1bs   | *           |            |               |  |  |
| Mean Mixture Ratio, o/f  | ×           |            |               |  |  |
| Pulse Total Impulse, 1b-sec  | . 8454      |            |               |  |  |
| Mean Specific Impulse, sec   | *           |            |               |  |  |
| Shutdown Impulse, 1b-sec (.260 max) **                                   | .2479       |            |               |  |  |
| Cut-Off Time, msec   | 18.3        |            |               |  |  |
| Oxidizer Valve Voltage, volts  | 26          |            |               |  |  |
| Fuel Valve Voltage, volts  | 26          |            |               |  |  |
| Oxidizer Valve Current, amps   | .636        |            |               |  |  |
| Fuel Valve Current, amps   | 1623        |            |               |  |  |
| Electrical Power, watts  | 32.7        |            |               |  |  |
| * Flows Unreadable - Instrumentation Problem ** Ref: NA-SE6-289Rl        | <b>13</b>   |            | 3/            |  |  |
| Prepared by: Checked by:   | / Appr      | N Tol baye | M Cor:        |  |  |
| 12/ 320 human / My furtherly / FORM 608-8-37 NEW 6-63                    | K K         | A Con N    |               |  |  |
| FORM 608-B-37 NEW 6-63   |             |            |               |  |  |

| COMPONENT N  | AME THRUST CHAITBER ASSEMBLY - 25#  | PART NO.        | 208160-61          |   |
|--------------|-------------------------------------|-----------------|--------------------|---|
| NAME OF TEST | DAT BUTY CYCLE TO FAILURE           | TEST NO. 203360 | (.0)               |   |
| •            | Sequence Number 15 Pulse Number 4   | Site<br>Data    | Standard<br>Vacuum |   |
|              | Firing Duration, sec                | .694            |                    |   |
|              | Accumulated Firing Time, sec        | 77.1            |                    |   |
|              | Data Slice Number                   |                 |                    |   |
| •            | Time of Data Slice, sec             | _65             |                    | • |
|              | Environmental Pressure, psia        | 1011            | 0                  |   |
|              | Environmental Temperature, °F       | 87 (VA          | oc. chamber)       |   |
|              | Oxidizer Temperature, OF            | 90              | 70                 |   |
|              | Fuel Temperature, OF                | . 90            | 70                 |   |
| •            | Oxidizer Inlet Pressure, psia       | 290.7           | 292                | • |
| •            | Fuel Inlet Pressure, psia           | 292.6           | 292                | • |
|              | Oxidizer Flowrate, lbs/sec          | .0470           | .0473              |   |
| . •          | Fuel Flowrate, lbs/sec              | · 18355         | .0355              |   |
|              | Mixture Ratio, o/f (1.30+6%)        | 1.32            | 1.33               | ٠ |
| •            | Thrust, 1bs (23.0+5%)               | 23.6            | 23.7               |   |
|              | Specific Impulse ( [ ] )            | 286             | 286                |   |
|              | Start Time, msec (25 max)           | 14.5            |                    | • |
|              | Shutdown Impulse, 1b-sec (.260 max) | * 2316          | •                  |   |
|              | Oxidizer Valve Voltage, volts       | 28.9            |                    |   |
|              | Fuel Valve Voltage, volts           | 29.2            |                    |   |
|              | Oxidizer Valve Current, amps        | . 1658          |                    | • |
| -            | Fuel Valve Current, amps            | .647            |                    |   |
|              | Electrical Power, watte             | 37.9            |                    |   |

\*\* Ref: ECN NA-SE6-289Rl

| Prepared by:                | Chocked by | the of | Approved for MAA by |
|-----------------------------|------------|--------|---------------------|
| 1 CHH 608-8-37 NEW 6-63 248 |            |        | R-15019-2           |

| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# PART NO. MAC 52-52701-265  NAME OF TEST DAT DUTY CYCLE TO FAILURE TEST NO 203160-SHEET OF |                |             |       |  |  |  |
|--|----------------|-------------|-------|--|--|--|
|  | _ TEST NO. 200 | OTOO- SHEET | OF    |  |  |  |
| Sequence Number 17   | •              | •           |       |  |  |  |
| Pulse Humber   | 9              |             |       |  |  |  |
| Signal Width, msec   | 48.2           |             |       |  |  |  |
| Start Time, msec (25 max.)   | 14.0           |             |       |  |  |  |
| Environmental Pressure, psia   | .011           |             |       |  |  |  |
| Environmental Temperature, or  | 70             |             |       |  |  |  |
| Oxidizer Inlet Temperature, OF   | 70             |             |       |  |  |  |
| Fuel Inlet Temperature, F  | 70             |             |       |  |  |  |
| Oxidizer Inlet Pressure, psia  | 292            | $\supset$   | ·     |  |  |  |
| Fuel Inlet Pressure, psia  | 292            | •           |       |  |  |  |
| Total Oxidizer Flow, 1bs   | . *            |             |       |  |  |  |
| Total Fuel Flow, 1bs   | *              |             |       |  |  |  |
| Mean Mixture Ratio, o/f  | *              |             |       |  |  |  |
| Pulse Total Impulse, 1b-sec  | 1.1797         |             |       |  |  |  |
| Mean Specific Impulse, sec   | *              | ·           |       |  |  |  |
| Shutdown Impulse, 1b-sec (.260 max) **   | , 2365         |             |       |  |  |  |
| Cut-Off Time, msec   | 23.2           |             |       |  |  |  |
| Oxidizer Valve Voltage, volts  | 26             |             | :     |  |  |  |
| Fuel Valve Voltage, volts  | 26             |             |       |  |  |  |
| Oxidizer Valve Current, amps_  | ,636           |             |       |  |  |  |
| Fuel Valve Current, amps   | ,623           |             |       |  |  |  |
| Electrical Power, watts  | 32.7           |             | ·     |  |  |  |
| ** Flows Unreadable - Instrumentation Record *** Ref: ECN NA-SE6-289Rl   | lings          |             | V.    |  |  |  |
| Prepared by:  Checked by:  White form 608-8-37 NEW 6-63  | App            | Sol tox Na  | A by: |  |  |  |

| COMPONE | NT NAME THRUST CHAIRER ASSEMBLY - 25# | PART NO.       | 208160-61          |     |
|---------|---------------------------------------|----------------|--------------------|-----|
| NAME OF | TEST DAT DUTY CYCLE TO FATHER         | TEST NO. 20336 | 1.01               | ·   |
| •       | Sequence Number 23 Pulse Number 4     | Site<br>Data   | Standard<br>Vacuum | -   |
| •       | Firing Duration, sec                  | .688           |                    |     |
|         | Accumulated Firing Time, sec          | 117.9          |                    |     |
|         | Data Slice Number                     | 6              | • .:               |     |
| •       | Time of Data Slice, sec               | .65            |                    |     |
|         | Environmental Pressure, psia          | _011           | 0                  |     |
|         | Environmental Temperature, °P         | 89 (V)         | ac. chamber)       |     |
|         | Oxidizer Temperature, OF              | 90             | 70                 |     |
| •       | Fuel Temperature, OF                  | . 90           | 70                 |     |
|         | Oxidizer Inlet Pressure, psia         | 295.5          | 292                | • • |
|         | Fuel Inlet Pressure, psia             | 292.6          | 292                |     |
|         | Oxidizer Flowrate, lbs/sec            | .0464          | .0462              |     |
| •       | Fuel Flowrate, lbs/sec                | .0357          | .0359              |     |
|         | Mixture Ratio, o/f (1.30+6%)          | 1.30           | 1.29               |     |
| •       | Thrust, 1bs (23.0+5%)                 | 23.7           | 23.7               |     |
| •       | Specific Impulse (200 min.)           | 289            | 289                | •   |
|         | Start Time, msec (25 max)             | 13.5           | •                  | •   |
| •       | Shutdown Impulse, 1b-sec (.260 max)   | * .2293        |                    |     |
| •       | Oxidizer Valve Voltage, volts         | 29.1           |                    |     |
|         | Fuel Valve Voltage, volts             | 29.3           | •                  |     |
|         | Oxidizer Valve Current, amps          | . 1653         |                    |     |
|         | Fuel Valve Current, emps              | 641            |                    |     |
|         | Electrical Power, watte               | 37.8           |                    | •   |

\*\* Ref: ECN NA-SE6-289R1

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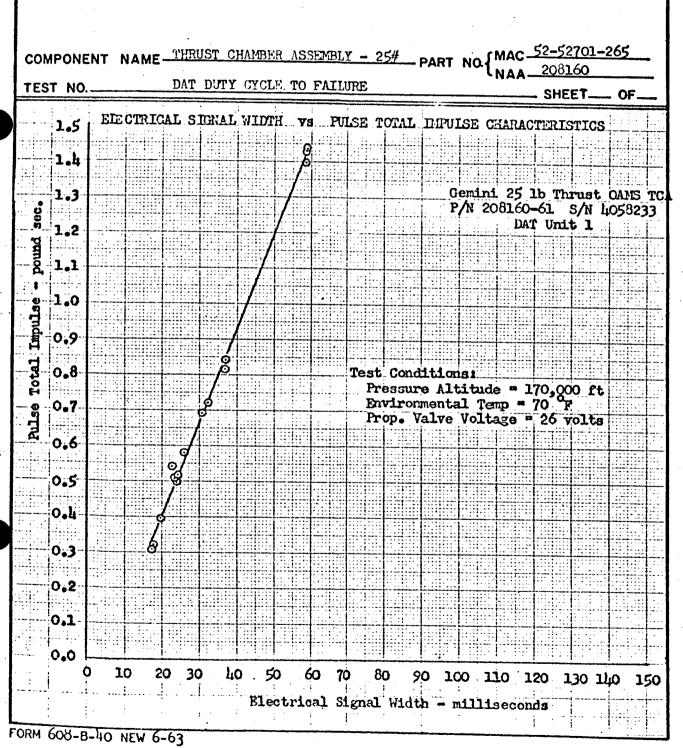
Prepared by:

Checked by:

Approved Cr NA by:

FORM 608-8-37 NEV 6-63 950

| COMPONENT NAME THRUST CHAMBER ASSETBLY - 25#                              | PART NO.    | MAC 52-527<br>MAA 20816 | 01 <u>-265</u> |     |
|---|-------------|-------------------------|----------------|-----|
| NAME OF TEST DAT DUTY CYCLE TO FAILURE                                    | TEST NO. 20 |                         |                |     |
| Sequence Number 25  |             |                         |                |     |
| Pulse Number  | 2           | 6                       | • .            | 7   |
| · Signal Width, msec  | 51.6        | 51.7                    | <del></del>    | ┨.  |
| Start Time, msec (25 max.)  | 13.4        | 13.4                    | •              | 1   |
| Environmental Pressure, psia  | .011.       | .011                    | <del></del>    | 1   |
| Environmental Temperature, OF   | 70          | 70                      | <del></del> .  | 1   |
| Oxidizer Inlet Temperature, OF  | 70          | 70                      |                | 1   |
| Fuel Inlet Temperature, or  | 70          | 70                      | ·              | 1   |
| Oxidizer Inlet Pressure, psia   | 292         | 292                     | 1              | 1   |
| Fuel Inlet Pressure, psia   | 292         | 292                     | ب              | 1   |
| Total Oxidizer Flow, lbs  | X           | *                       |                | 1   |
| Total Fuel Flow, 1bs  | # .         | *                       |                | 1   |
| Mean Mixture Ratio, o/f   | *           | ×                       |                | 1   |
| Pulse Total Impulse, 1b-sec   | 1.2708      | 1.2931                  |                | 1   |
| Mean Specific Impulse, sec  | . *         | *                       |                | 1   |
| Shutdown Impulse, lb-sec (.260 max) **                                    | 2483        | , 2460                  | •              | 1   |
| Cut-Off Time, msec  | .21.8       | 24.7                    |                | 1   |
| Oxidizer Valve Voltage, volts   | 26          | 26                      |                | 1 . |
| Fuel Valve Voltage, volts   | 26          | 26                      |                | 1   |
| Oxidizer Valve Current, amps  | .636        | .636 .                  |                | 1   |
| Fuel Valve Current, amps  | .623        | ,623                    | '              |     |
| Electrical Power, watts   | 32.7        | 32.7                    |                |     |
| * Flows Unreadable - Instrumentation Problems  * ** Ref: ECN NA-SE6-289R1 |             | •                       | , C.           | 1   |
| Prepared by:  Checked by:  White  FORM 608-B-37 NEW 6-63                  | Appy        | Migrael                 | AA by:         |     |



10 X 10 TO THE CM. 359-14 KEUFFEL & ESSER CO. HAN IN U. S.A.

| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# PART NO. \[ \begin{array}{lllll} MAG \( \frac{52-52701-265}{NAA} \) 208160-61  NAME OF TEST DAT DUTY CYCLE TO FAILURE TEST NO. \( \frac{208160-51}{208160-51} \) TEST NO. \( \frac{208160-51}{208160-51} \) 870F 38   |
|--|
|  |
| 7.1.4.2.5 Failure Data   |
| Accumulated Firing Time, sec. 177. (MDC)   |
| Description of Failure Mode:   |
| THE MOCTEST ON UNIT I WAS  |
| TERMINATED AFTER 177 SECONDS   |
| OF ACCUMULATED (MOC) BURN TIME.  |
| THE MODE OF "FAILURE" WAS SHELL  |
| TEMPERATURES IN EXCESS OF THE  |
| SPECIFICATION MAXIMUM THAT   |
| DEFINES THE TEST TO "FAILURE"  |
| •  |
|  |
|  |
| PREPARED BY DATE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFYED FOR MCDONNELL DATE CERTIFYED FOR MC |
| FORM 608-B-39 NEW 6-63   |

5.7

UNITAL

## IROCICIE TIDY IN THE INSPECTION DISCREPANCY AND CORRECTION RECORD

Serial No. <u>#058233</u>

Dwg. No. 208/60-61

MAKE ENTRY CLEAR AND CONCISE, USE INK

Model SE-7 OAMS

|            | ,            | NAME ENTRY CLEAR AND CONCISE, USE INR   | lodel_ <i>SE</i>   | <u>-7</u>                             | OAMS                    |
|------------|--------------|---|--------------------|---------------------------------------|-------------------------|
| DCP        | Ent'd        | DESCRIPTION OF DISCREPANCY AND ACTION TAKEN   | CI                 | EARED E                               | BY                      |
| No.        | By &<br>Date | C+L II Cell'39  | Mech.<br>&<br>Date | Lead-<br>man &<br>Date                | Insp.<br>&<br>Date      |
| ,          |              | PART NO. PARA 7.1.2.2.3.8 SPECIFIES X AXIS.   | SHOU               | LP                                    | <del></del>             |
| ′          | 9/5/4        | BE Z AXIS   | <del></del>        | · · · · · · · · · · · · · · · · · · · |                         |
| ACT<br>TAK | ION<br>(EN   | Para 7.1.2.2 2.8 11/15 1/21d  | ]                  | ANR<br>224                            | A <sup>N</sup> R<br>229 |
|            | 10/          | as and and and and and and and and and and  | 114                | 9-11                                  | 64                      |
| 2          | 12/          | PART NO. GENERAL: N.T.O. CHEM ANALYSIS DOES NOT CO  | CMPLY              | WITT                                  |                         |
| x.         | (***)        | MIL-ST-26539A FOR WATER CONTENT.  |                    |                                       | •                       |
| AC1<br>TAK | ION          | LATEST CHEM ANALYSIS ON N.T.O DOES COMPLY   |                    | (4.V/1)                               | (3)                     |
| 100        |              | WITH MIL. P-26539A  | jo-                | 2-6                                   | 64                      |
|            | ic/<br>/3/   | PART NO. 208160-61 5/114058233 CAPE CYCLE FIRING NA   | OF PER             | FORME                                 | מ                       |
| 3          | /64<br>(***) | TO DAT SPEC. REF. PAR. 7.1.4.1.1.1.   | <del></del>        | · · · · · ·                           | ·                       |
| ACT<br>TAK | ION          | MAC SCO 52. ST. 731, REV. 7 SPECIATES A FIVE, FOUT, FIVE, TO D. FIVE FOUT, FIVE, TO D. FIVE MINUTE WAITS DURING CAPE CYCLE. THE DAY SPE | 7 Par , -          | ₹\$5.                                 | W3 8                    |
| 144        | LIN          | THE MAC SCD. July Salvings - 576-388 10-3-64  |                    | (3)                                   |                         |
| 4          | 19/3         |   | aive               | d v                                   | IIA                     |
| ſ          |              | Telecon 134 MAC OC MR. Michals  | ·                  |                                       |                         |
| ACT        | ION          |   | 7005               | ( <del>)</del>                        | (4) J 6                 |
| TAK        | EN           | INFORMATION ONLY  |                    | (B)                                   | <b>3</b>                |
| 5          | 19/          | PART NO. 208160-61 SIN4058233 T.C.H. Test   |                    | 90                                    |                         |
|            | 164<br>65    | Exceeded 550°F Prior To Accumulation  |                    |                                       |                         |
| l          | ION          | Fiving Time. Ref. Table IL Note # 2   | 10.                | [ <del>-</del>                        | 4                       |
| TAK        |              | TANKTORD T. SUBSTICE WILL   | 1 (2)              | 13.3                                  | (33)                    |
| orm R      | 25-4-8-      | TRANSTERFD TO SHORTAGE 10/3/64  |                    | <u>L</u>                              | <u> </u>                |

VENTA

### INSPECTION DISCREPANCY AND CORRECTION RECORD

Serial No. <u>4058233</u>

Dwg. No. <u>208160-61</u>

MAKE ENTRY CLEAR AND CONCISE, USE INK

Model SR.7 DAMS

|                                       |              |   | logel          |                | 07143            |
|---------------------------------------|--------------|---|----------------|----------------|------------------|
| DCP                                   | Ent'd        | DESCRIPTION OF DISCREPANCY AND ACTION TAKEN |                | LEARED         | ВҮ               |
| No.                                   | By &<br>Date | CtLII Cell'39                               | Mech.          | Lead-<br>man & | Insp.            |
|                                       | 19/          |   | Date           | Date           | Date             |
| C                                     | 1/1          | PART NO. 208/60-61 S/N 4058233 T.C.A.       | test           | 1-50 C         | 90               |
|                                       | 60           | Terninated After 13,280 Sec of Ru.          | N T.           | me             | due              |
|                                       |              | to overtemp Ret TAble IL Note               | £3.            |                |                  |
| ACT<br>TAK                            | ION          |   | 1              | 5-             | 1 ' 1            |
| İAN                                   | EN           | TRANSFERED TO SHEETAGE 10/5/64              | 30             | 1537           | (E)              |
| 2                                     | 1%           | PART NO. 208160-61 S/N 4058233 T/A          | Doce           | mts            | oinst.           |
| İ                                     | 164          | up to 6.8.30                                | <i></i>        |                |                  |
|                                       |              |   |                |                |                  |
| ACT                                   |              |   | 10-            | 56             | 4-1              |
| TAK                                   |              | DECONTAMINATION COMPLETE THRU 6.8.37        | (376)          | (A. n)         | (A)(A)<br>(\$35) |
|                                       |              | PART NO.                                    | 439            | (35)           | 20               |
|                                       | ł            | Insp. Complete at C.T.L. 3                  |                |                |                  |
|                                       | ŀ            |   |                |                |                  |
| اــــــــــــــــــــــــــــــــــــ |              |   | -1             | ı <del>-</del> | <b>1</b> -       |
| TAKE                                  |              |   | -              |                |                  |
| T                                     |              |   |                |                |                  |
|                                       | - }          | PART NO.                                    |                |                |                  |
|                                       | -            |   |                |                |                  |
|                                       | -            |   |                |                |                  |
| ACTI<br>TAKE                          | ОИ           |   |                |                | [-1              |
|                                       |              |   | 1              |                |                  |
|                                       |              | PART NO.                                    |                | 1              | <u> </u>         |
|                                       |              |   |                |                |                  |
|                                       | Ì            |   |                |                |                  |
| ACTI                                  |              | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~     | - <sub>1</sub> | т — -          | ,                |
| TAKI                                  |              |   | -              |                |                  |
| Facons<br>to a 2 2                    | 3.00         | v. 12.57 OFF                                |                |                |                  |
| 1                                     | U <b>K</b> ⊕ | . 12.57 256                                 | R-15           | 019-2          |                  |

| COMPONENT NAME _ | THRUST CHAMBER ASSEMBLY - 25# | PART NO. MAC 52-52701-265  |
|------------------|-------------------------------|--|
| NAME OF TEST     | DISASSEMBLY AND INSPECTION    | _PART NO. { MAC _52-52701-265<br>NAA _208160-61<br>_TEST NO. 20816.0-SHEET_88_OF_380 |

REFERENCE: MAC SCD 52-52701, Revision F, Paragraph 6.2.3.20.1

- 7.1.5 Disassembly and Inspection
- 7.1.5.1 Test Procedure
- 7.1.5.1.1 Prior to sectioning the TCA perform a visual inspection and record the post test condition of the TCA.
- 7.1.5.1.2 Section the TCA by cutting along line C-D-E as depicted in Figure 11.
- 7.1.5.1.3 Perform visual inspection of all detailed parts for evidence of damage, distortion, fluid incompatability, corrosion, broken parts and impending failure.
- 7.1.5.1.4 After test completion identify the sectioned TCA and detailed parts and package and store for reference.

NOTE: Only authorized personnel shall have access to stored DAT hardware.

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|                     |                   |        | <del></del>             |      |
|---------------------|-------------------|--------|-------------------------|------|
| PREPARED BY: DATE   | APPROVED FOR NAA: | DATE   | APPROYED FOR MCDONNELL: | DATE |
| E. Adams 7-20-64    | DNP               | - 1    |                         |      |
| CHECKED BY: DATE    | 7 KARia           | 8-4-64 |                         | _    |
| 1 31 thenews (.3.64 | 18 10(00          | 0 1 -1 |                         |      |
|                     |                   |        |                         |      |

FORM 608-B-38 NEW 6-63

#### ROCKETDYNE A DIVISION OF NORTH AMERICAN AVIATION, INC.

IL 4388-5234

INTERNAL LETTER

North American Aviation, Inc.

DATE

20 November 1964

TO Address Those Concerned

FROM Address Gemini DAT-RAT Unit

D/896-388

SUBJECT

Deviation From Specification 208160-401

Further disassembly and inspection is requested on 25 lb OAMS TCA Unit #1, P/N 208160-61, S/N 4058233, in order to evaluate the potting compound in the vicinity of the mountting bosses.

Pictures will be taken of the present condition of the TCA section and subsequent to additional sectioning.

Below is a sketch of the planned sectioning.

A. Cola

Gemini DAT-RAT Unit

Approved:

R. G. Eide Supervisor

Gemini DAT-RAT Unit

J. Wavrogenis MAC Engineering

258

| •                         | THRUST CHAMBER ASSEMBLY - 25#  | CMAC                     | 52-52701-265                                 |
|---------------------------|--|--------------------------|--|
| COMPONENT NA              | ME   | _ part no { MAC_<br>NAA_ | 208160-61                                    |
| NAME OF TEST_             | DISASSEMBLY AND INSPECTION   | TEST NO. 208160-         | 401<br>SHEET 89 OF 380                       |
| 7.1.5.2                   | Post Test Inspection Data - TCA #1   |                          | ,  |
| 7.1.5.2.1                 | Component Identification   |                          | •  |
|                           | Component Name TCA   |                          |  |
| •                         | McDonnell Part No. 52-52701-   | 26V (NA)                 | •  |
|                           | Rocketdyne Part No. 208160-61  | (FOE)                    |  |
| •                         | Component Serial No. 4008233   | (600)                    |  |
| 7.1.5.2.2                 | Preliminary Inspection (Reference  | paragraph 7.1.           | 5.1.1 )                                      |
|                           | The TCA was visually inspected price TCA condition was as follows:   | or to sectioning         | and the                                      |
| 7.1.5.2.3                 | EXTRUCT OF TEA IS HEAVY CONTROL OF TEA IS MISS COUTH FITTINGS ART INTRUCTOR (Refer Disassembly and Inspection (Refer | SING. EXTRA LONG         | 778E EXTENSOUS                               |
|                           | The TCA was sectioned along line Cinspected. The results of the inspected follows:                                   | pection were as          |  |
|                           | CHARRED ABLATINE, THREAT,  | voes + shore             | - S  |
|                           | THROAT IS GOUDED, NAME PO<br>VALVES HAVE BEEN REMOVE   | 2. A. *                  | RK IV  |
| PREPARED BY 7-/6 B. Adams | 816-0008 RV. Suich   | 1.D. 2                   | Correscons 1/3/64 OBY USAF 1/3/64 And Aluff. |
| FORM 608-B-39             | NEW 6-63   |                          | 011  |

### ROCKETDYNE

A DIVISION OF NORTH AMERICAN AVIATION, INC.

IL 4388-5152

INTERNAL LETTER

North American Aviation, Inc.

DATE

22 October 1964

TO Address Those Concerned

FROM

Gemini DAT-RAT Unit

Address D/896-388

PHONE

6608

SUBJECT

Plan of Action - Deviation to Gemini DAT TCA Specifications 208130-401 and 208160-401 for Purpose of Completing Testing Requirements

The pre-functional failure on the RCS DAT Unit #1 oxidizer propellant valve, P/N h05557, S/N 875999, during the explosive atmosphere test necessitates the following deviations in order to accomplish completion of the prescribed testing.

Identical propellant valves are currently available on OAMS 25 lb DAT Unit #1, P/N 2081660-61, S/N 4058233, which has completed the prescribed test requirements for that unit. It is proposed that the propellant valves from this unit be utilized to conduct the remaining test requirements, explosive atmosphere and propellant resistance, for RCS 25 lb TCA Unit #1.

The procedures undertaken to accomplish the aforementioned shall be:

- The propellant valves shall be removed from OAMS 25 lb TCA Unit #1.
- 2. The propellant valves of item 1 shall be subjected to a pre-functional test identical to the requirements of the DAT specification 208130-401, explosive atmosphere test. Quality control surveillance shall be required.

3. If the propellant valves successfully demonstrate fulfillment of the test requirements the results of the tests, the data sheets, duly certified, shall be inserted in the DAT specification attesting to the completion of the required explosive atmosphere

pre-functionals.

B. Cole

Gemini DAT-RAT Unit

Approved:

W. Smith

Supervisor

Propellant Controls

R. G. Eide

Supervisor Gemini DAT-RAT Unit

R.Mantler 12 Oct 64
MAC Rep.

### PROPELLANT VALVE PROOF PRESSURE AND LEAKAGE

- 6.1 Propellant Valve Proof Pressure and Leakage.
- 6.1.1 Install the TCA in a test setup as shown in Figure 2.

  If the propellant valves have been removed from the TCA, they shall be equipped with propellant valve outlet adapters. Do not attach the leakage sensing line at this time.

NOTE: It shall be necessary to perform this test in a hazardous test cell. See paragraph 3.8.

- 6.1.2 Slowly adjust the regulated helium supply pressure at the oxidizer propellant valve inlet to 500 +10 psig as indicated by the pressure gage.
- 6.1.3 Maintain this pressure for a period of not less than three minutes.
- 6.1.4 De-pressurize the oxidizer propellant valve.
- 6.1.5 Adjust the regulated helium supply pressure to 150 ±10 psig.
- 6.1.6 Adjust the DC power supply to 26 +0.5 VDC.
- 6.1.7 Cycle the oxidizer propellant valve three times and leave in the closed position.
- 6.1.8 Attach the leakage sensing line and arrange the leakage testing equipment as shown in Figure 2.
- 6.1.9 Adjust the regulated helium supply pressure to 500 +10psig.

Prepared By: Date Checked By: Date Approved for NAA:

10-30-64

### PROPELLANT VALVE PROOF PRESSURE AND LEAKAGE

- At first indication of leakage, wait at least two minutes to insure a steady leakage rate and then measure the leakage over a period of at least five minutes with a stopwatch. If no leakage is apparent after five minutes or if the measured leakage is less than 0.5 ml, record the leakage rate at "less than 0.1 scc He/MIN." The maximum allowable leakage is 2.23 scc He/MIN.
- 6.1.11 De-pressurize the oxidizer propellant valve. Disconnect the helium supply line, the DC power supply and the leakage sensing line. Cap the oxidizer propellant valve inlet port and electrical receptacle.
- 6.1.12 Failure to pass the above tests shall constitute a failure of the oxidizer valve. See paragraph 3.6.1.
- 6.1.13 Repeat the above procedure on the fuel propellant valve.
- 6.1.14 Remove the TCA from the test setup. Replace all protective covers.

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Prepared By:

R-15019-2

Approxed for NAA:

1 Ele 10-21-64

Date

JALug-

Checked By:

Date

7-30-64

#### PROPELLANT VALVE PROOF PRESSURE AND LEAKAGE

- At first indication of leakage, wait at least two minutes to insure a steady leakage rate and then measure the leakage over a period of at least five minutes with a stopwatch. If no leakage is apparent after five minutes or if the measured leakage is less than 0.5 ml, record the leakage rate at "less than 0.1 scc He/MIN." The maximum allowable leakage is 2.23 scc He/MIN.
- 6.1.11 De-pressurize the oxidizer propellant valve. Disconnect the helium supply line, the DC power supply and the leakage sensing line. Cap the oxidizer propellant valve inlet port and electrical receptacle.
- 6.1.12 Failure to pass the above tests shall constitute a failure of the oxidizer valve. See paragraph 3.6.1.
- 6.1.13 Repeat the above procedure on the fuel propellant valve.
- 6.1.14 Remove the TCA from the test setup. Replace all protective covers.

R-15019-2

262

Prepared By:

15 le 10-21-64 JAX

JALange 10-30-

Date

Checked By:

Store

Approxed for NAA:

### PROPELLANT VALVE ELECTRICAL RESISTANCE

| 6.3 <u>P</u> | ropellant Valve | Electrical | Resistance |
|--------------|-----------------|------------|------------|
|--------------|-----------------|------------|------------|

- Install the electrical harness on the propellant valves. Provide an environmental temperature of 70 ±5 F until temperature stabilization is obtained. Stabilization is defined as a temperature variation of not more than ±3 F for a 30 minute time period.
- 6.3.2 Adjust the impendance bridge to measure resistance.
- 6.3.3 Measure and record the resistance between leads A and B of the oxidizer valve. The acceptable resistance is presented in Figure 12.
- 6.3.4 Measure and record the resistance between leads C and D of the oxidizer valve. The maximum acceptable resistance is 1.0 ohm.
- 6.3.5 Failure to pass the above test shall constitute a failure of the propellant valve. See paragraph 3.6.
- 6.3.6 Repeat paragraphs 6.3.3 and 6.3.4 on the fuel valve.
- 6.3.7 Remove Electrical harness from propellant valves and replace protective covers on propellant valve electrical connectors.

Prepared By: Date Checked By: Date Approved for NAA:

RCeCo 10-21-69 Mage 10-30-64 Approved for NAA:

10-30-64

### PROPELLANT VALVE DIELECTRIC STRENGTH

### 6.4 Propellant Valve Dielectric Strength

- 6.4.1 Install the electrical harness on the propellant valves.

  Attach ground leads to each of the propellant valve electrical connector bodies by means of alligator clips.
- 6.4.2 Adjust the 60 cps AC voltage output of the leakage tester to zero.
- 6.4.3 Set the capacity compensation selector switch on the leakage tester to "NONE".
- 6.4.4 Connect one of the leakage tester leads to lead A of the oxidizer valve and the other lead to the oxidizer valve ground lead.
- Depress power switch on the leakage tester, and adjust the voltage control until 500  $^{+10}_{-0}$ VRMS is indicated on the coltmeter. If the leakage tester ammeter reads off-scale, reduce the voltage until approximately 800 microamps is indicated on the ammeter.
- 6.4.6 Rotate the capacity compensation selector switch until a minimum current flow is indicated on the ammeter.
- 6.4.7 Adjust the voltage control until 500  $_{-0}^{+10}$ VRMS is indicated on the voltmeter.
- 6.4.8 Observe the ammeter for a period of one minute. Maximum allowable current leakage is 500 micro-amps.
- Release the leakage tester power switch and disconnect the leakage tester leads.

Prepared By: Date Checked By: Date Approved for NAA:

A E. C. 16-21-64

1 A Sange 10-30-64

#### PROPELLANT VALVE DIFLECTRIC STRENGTH

- 6.4.10 Repeat paragraphs 6.4.2 and 6.4.3.
- 6.4.11 Connect one of the leakage tester leads to lead C of the oxidizer valve and the other lead to the oxidizer valve ground lead.
- 6.4.12 Repeat paragraphs 6.4.5 through 6.4.9.
- 6.4.13 Repeat paragraphs 6.4.2 and 6.4.3.
- 6.4.14 Connect one of the leakage tester leads to lead A of the oxidizer valve and the other to lead C of the oxidizer valve.
- 6.4.15 Repeat paragraphs 6.4.5 through 6.4.9.
- 6.4.16 Failure to pass the above test shall constitute a failure of the propellant valve. See paragraph 3.6.
- 6.4.17 Repeat paragraphs 6.4.2 through 6.4.15 on the fuel valve.
- 6.4.18 Remove the electrical harness and the ground leads from the propellant valves and replace the propellant valve protective covers.
- 6.4.19 Replace protective caps.

Prepared By: Date Checked By: Date Approved for NAA:

11 Colo 10-21-64 J. Abangur 10-30-64 Steride

#### PROPELLANT VALVE FUNCTIONAL

- 6.5.8 Adjust the GN<sub>2</sub> supply pressure to 300 ±10 psig.
- 6.5.9 Adjust the DC power supply voltage to zero.
- 6.5.10 Close the mercury switch.
- 6.5.11 Increase the DC power supply voltage until the oxidizer valve opens as indicated by a pressure drop. The maximum acceptable pull in voltage is 16 VDC as indicated on the output voltmeter.
- 6.5.12 Reduce the GN<sub>2</sub> supply pressure to zero.
- 6.5.13 Reduce the DC power supply voltage until the propellant valve closes. Note deflection on milliammeter which indicates valve closing. Record valve closing voltage. The minimum acceptable drop out voltage is 1.0 volts.
- 6.5.14 Open the mercury switch.
- 6.5.15 Failure to pass the above test shall constitute a failure of the oxidizer valve. See paragraph 3.6.
- 6.5.16 Repeat paragraphs 6.5.1 through 6.5.15 on the fuel propellant valve.
- 6.5.17 Renove electrical leads and the GN2 supply.
- 6.5.18 Replace all protective closures.

| Prepared By: Date | Checked By: Dat | e Approved for NAA: |
|-------------------|-----------------|---------------------|
| 1. Colo 10-21-64  | laserge 10-30   | -4 Staide           |
|                   |                 | 10-30-64            |

#### PROPELLANT VALVE FUNCTIONAL

### 6.5 Propellant Valve Functional

- 6.5.1 Install the TCA in a test setup as shown in Figure 4. Provide a temperature environment of 70 +5 F until temperature stabilization is obtained. Stabilization is defined as a temperature variation of not more than +3 F for a 30 minute time period. Connect the current trace lead to the oxidizer valve. Do not connect the voltage trace lead.
- 6.5.2 Adjust the pressure regulator to obtain 300 ±10 psig on the pressure gage.
- 6.5.3 Adjust the DC power supply so that 26 ±0.5 VDC is read on the voltmeter.
- 6.5.4 Close the mercury switch and record the oscilloscope current trace with the Polaroid camera. A sample current trace is shown in Figure 5. The maximum valve opening response time is 0.0065 seconds from electrical signal to poppet open. See Figure 5 for typical valve opening response characteristics. Open the mercury switch.
- 6.5.5 Reduce the GN2 supply pressure to zero.
- 6.5.6 Disconnect the current trace lead and connect the voltage trace lead.
- 6.5.7 Close the mercury switch to verify that the oxidizer valve has opened. Then open the mercury switch and record the oscilloscope voltage trace with the Polaroid camera. A sampling voltage trace is shown in Figure 5. The maximum valve closing response time is 0.0035 seconds from electrical signal to poppet closed.

| Prepared By: | Date   | Checked By: | Date     | Approved for NAA: |
|--------------|--------|-------------|----------|-------------------|
| Revle 10     | -21-64 | 2a Sanger   | 10-30-64 | Steide            |
|              | ·      |             | -        | 10-30-68          |

| COMPONENT NAM | ME THRUST CHAMBER ASSEMBLY - 25# PART NO.  |  |  |  |  |  |
|---------------|--|--|--|--|--|--|
| NAME OF TEST_ | EXPLOSIVE ATMOSPHERE TEST NO208160-401 89.01 OF 380  |  |  |  |  |  |
| Reference:    | MAC SCD 52-52700, Revision G, Paragraph 6.2.3.13.  |  |  |  |  |  |
| 7.1.6         | Explosive Atmosphere - TCA #1  |  |  |  |  |  |
| 7.1.6.1       | Test Procedure   |  |  |  |  |  |
| 7.1.6.1.1     | Perform Propellant Valve Removal.  |  |  |  |  |  |
| 7.1.6.1.2     | Perform Propellant Valve Proof Pressure and Leakage per paragraph 6.1.   |  |  |  |  |  |
| 7.1.6.1.3     | Perform Propellant Valve Electrical Resistance per paragraph 6.3.  |  |  |  |  |  |
| 7.1.6.1.4     | Perform Propellant Valve Dielectric Strength per paragraph 6.4.  |  |  |  |  |  |
| 7.1.6.1.5     | Perform Propellant Valve Functional per paragraph 6.5.   |  |  |  |  |  |
| 7.1.6.1.6     | Install the propellant valves in an explosion test chamber in accordance with Figure 13.   |  |  |  |  |  |
| 7.1.6.1.7     | Instrumentation shall be provided for monitoring propellant valve body temperature and the test chamber ambient air temperature.   |  |  |  |  |  |
| 7.1.6.1.8     | Seal the explosion test chamber and raise the internal temperature to 160 ±5 F.  |  |  |  |  |  |
| 7.1.6.1.9     | Allow the temperature of the propellant valve to rise within 20 Frof the temperature of paragraph 7.1.6.1.8. Section 1.1.6.1.8.  |  |  |  |  |  |
| 7.1.6.1.10    | Reduce the pressure within the test chamber to simulate a pressure altitude of 10,000 feet above the desired test altitude. The desired test altitude for the first test is sea level. |  |  |  |  |  |
| PREPARED BY:  | DATE APPROVED FOR NAA: DATE APPROVED FOR MCDONNELL: DATE   |  |  |  |  |  |
|               | 10-31-64<br>DATE<br>10-31-64<br>DEM 6 62   |  |  |  |  |  |
| ORM 608-B-38  | NEW 6-63   |  |  |  |  |  |

| COMPONENT NAME    | THRUST CHAMBER ASSEMBLY - 25# PART NO. { MAC 52-52701-265 NAA 208160-61   |
|-------------------|---|
| NAME OF TEST      | EXPLOSIVE ATMOSPHERE TEST NO 208160- SHEET OF 380   |
| 7.1.6.1.11        | Introduce into the test chamber, in proper quantity, commercial. butane so that an explosive atmosphere is attained for the desired test altitude.  |
| 7.1.6.1.12        | Return the test chamber's pressure altitude to 5000 feet above the desired test altitude by admitting air to the chamber.   |
| 7.1.6.1.13        | Allow the test chamber's explosive mixture to circulate for a period of three minutes.  |
| 7.1.6.1.14        | Energize the spark exciter within the combustion sampling chamber of the test chamber.  |
| 7.1.6.1.15        | If combustion is demonstrated within the combustion sampling chamber of the test chamber proceed with paragraph 7.1.6.1.16. If not, vent and purge the test chamber and repeat paragraphs 7.1.6.1.8 through 7.1.6.1.15.   |
| 7.1.6.1.16        | Energize the oxidizer valve with 26 ±1 VDC for a period of 10 seconds. Then de-energize. Explosion generated by actuation of the oxidizer valve shall constitute a failure. See paragraph 3.6.  |
| 7.1.6.1.17        | Energize the fuel valve with 26 ±1 VDC for a period of 10 seconds. Then de-energize. Explosion generated by actuation of the fuel valve shall constitute a failure. See paragraph 3.6.  |
| 7.1.6.1.18        | Repeat paragraphs 7.1.6.1.16 through 7.1.6.1.17 nine successive times.  |
| 7.1.6.1.19        | If explosion did not occur during performance of paragraphs 7.1.6.1.16 through 7.1.6.1.18, slowly admit air to the test chamber to produce a simulated pressure altitude of 5000 feet below the desired test altitude. If the desired test altitude is sea level, reduce the test chamber altitude to sea level. As the altitude is being lowered, perform paragraphs 7.1.6.1.16 and 7.1.6.1.17 once during each 1000 feet of drop. |
| PREPARED BY:      | DATE APPROVED FOR NAA: DATE APPROVED FOR MCDONNELL: DATE  |
| R. Cole RC        | 10-31-4   |
| Junius 10.        | DATE Starte   |
| FORM 608-B-38 NEV |   |

R-15019-2

### ROCKETDYNE

### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT NAM | E   |
|---------------|---|
| NAME OF TEST  | EXPLOSIVE ATMOSPHERE TEST NO 208160- SHEET OF 380   |
| 7.1.6.1.20    | Repeat paragraph 7.1.6.1.14. If combustion is not demonstrated vent and purge test chamber and repeat paragraphs 7.1.6.1.8 through 7.1.6.1.20.                                  |
| 7.1.6.1.21    | Vent and purge the test chamber.  |
| 7.1.6.1.22    | Repeat paragraphs 7.1.6.1.8 through 7.1.6.1.21 for each of the following desired test altitudes: 5000 feet, 10,000 feet, 20,000 feet, 30,000 feet, 40,000 feet and 50,000 feet. |
| 7.1.6.1.23    | Remove all test equipment, pressurant and electrical connections from the propellant valves.  |
| 7.1.6.1.24    | Perform Propellant Valve Proof Pressure and Leakage Test per paragraph 6.1.   |
| 7.1.6.1.25    | Perform Propellant Valve Electrical Resistance Test per paragraph 6.3.  |
| 7.1.6.1.26    | Perform Propellant Valve Dielectric Strength per paragraph 6.4.   |
| 7.1.6.1.27    | Perform Propellant Valve Functional Test per paragraph 6.5.   |
| 7.1.6.1.28    | Replace protective covers.  |

|               |          |                   |        | •                       |      |
|---------------|----------|-------------------|--------|-------------------------|------|
| PREPARED BY:  | DATE     | APPROVED FOR NAA: | DATE   | APPROVED FOR MCDONNELL: | DATE |
| R. Cole RC    | 10-31-64 | Did a             |        |                         |      |
| CHECKED BY:   | DATE     | 1/1/18            |        |                         |      |
| Gatinius      | 10-31-64 | 18 Taice          | 10-31- | C.Y.                    |      |
| FORM FOR B 28 | uru / /a |                   |        |                         |      |

M 608-B-38 NEW 6-63

### ROCKETDYNE A DIVIDION OF NORTH AMERICAN AVIATION INC

## DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# PART NO NAA 208160-61 TEST NO 208160-401 89.04 OF 380 NAME OF TEST. EXPLOSIVE ATMOSPHERE 7.1.6.2 Test Data - TCA #1 7.1.6.2.1 Component Identification Oxidizer Component Name Valve Valve 407559 Rocketdyne Part No. Component Serial No.

PREPARED BY DATE PERFORMED BY DATE VITNESSED FOR NAA DATE CEPTIFIED FOR MCDONNELL, DATE

R. Cole

R. Cole

R. Lo-3+64

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FORM 608-B-39 NEW 6-63

Oxidizer Valve

Fuel Valve

Rocketdyne P/N

Rocketdyne S/N

40> 559

9193579

407560 (P) 4059575 (P)

Prepared by Date Performed Date Witnessed for Date Verified by USAF NAA

RC 10-21-64 H.A. Ludwall Collaboration (22)

10-30-64 Collaboration (32)

10-30-64 Collaboration (32)

10-30-64 Collaboration (32)

## PROPELLANT VALVE PROOF PRESSURE AND LEAKAGE TEST (reference paragraph 6.1)

|   | Oxidizer Valve           | Fuel Valve          |
|---|--------------------------|---------------------|
| Proof Pressure  |                          |                     |
| Pressure<br>(500 <sup>+10</sup> )<br>-0<br>Time Duration<br>(3 minimum) | 500 psig                 | 500 psig            |
| Leakage<br>Voltage (26±0.5)<br>Inlet Pressure<br>(500+10)               | 2 6 921 VDC 500 (22 psig | 26 VDC<br>100 psig. |
| Time Duration (5 minimum)   | minutes minutes          | minutes             |
| Leakage Rate<br>(2.23 maximum)  | ZERO SCC He min          | ZERO CCC He         |
| Inspection Remarks  | NOVE 1/30/4              | (AHR)               |
|   |                          |                     |
|   |                          |                     |
|   |                          |                     |

| <u></u>                       |                |                     |                  |
|-------------------------------|----------------|---------------------|------------------|
| Prepared by Date  ACC 10-21-4 | Performed Dote | Witnessed for n.    | ••               |
|                               | by O           | witchessed for Date | Verified by USAF |
| 1 ROC 10-21-4                 | 170001 110     | MARCA               | 1.5              |
| of Cole                       | H// Turdwall   | C 6 1 25 - 7 (500)  |                  |
|                               | 10-30-64       | 11-35-17 (921)      | 10-55-01         |
|                               |                |                     | 10-17-59         |

### PROPELLANT VALVE ELECTRICAL RESISTANCE TEST (reference para.6.3)

| Environmental Temp | erature 7000             | )_(70 <u>+</u> 10 <b>°F)</b> | , y         |
|--------------------|--------------------------|------------------------------|-------------|
| Resistance         | A - B (P)                |                              |             |
| Oxidizer Valve     | 41.01 (82)<br>41.01 (82) | (Acceptable per Figur        | re 9,       |
| Fuel Valve         | 42.51 Ohms               |                              | -<br>19 9,  |
| Resistance         | C - D<br>(1.0 maximum)   |                              |             |
| Oxidizer Valve     | .QQ ohms                 |                              |             |
| Fuel Valve         |                          |                              |             |
| Inspection Remarks | NONE 10-                 | -30-64 (P)                   |             |
|                    |                          |                              |             |
|                    |                          | •                            |             |
|                    |                          | •                            |             |
|                    |                          |                              |             |
|                    |                          |                              | <del></del> |

| Prepared by Date | Performed Date             | Witnessed for Date | Verified by | USAF     |
|------------------|----------------------------|--------------------|-------------|----------|
| 10-21-69         | by/a. Lindwall<br>10-30-66 | 10-30-C4 (2)       | 12.         | 10-50-44 |

### PROPELLANT VALVE DIELECTRIC STRENGTH TEST (reference para. 6.4)

|             | Oxidizer | Valve                            | Fuel Valve                             |                            |  |  |  |  |
|-------------|----------|----------------------------------|--|----------------------------|--|--|--|--|
|             |          | Current<br>Microamps<br>500 max. | Voltage<br>Volts<br>500 <sup>+10</sup> | Current Microamps 500 max. |  |  |  |  |
| A to Ground | 500 E    | 38                               | 500 (2)                                | 34                         |  |  |  |  |
| C to Ground | 500 000  | 40 €                             | 500 (21)                               | 42 (3)                     |  |  |  |  |
| A to C      | 500      | 14                               | 500 (2)                                | 6 (ATR)                    |  |  |  |  |

|                                    | •   | ·<br>                                 | •                |
|------------------------------------|---|---------------------------------------|------------------|
| Prepared by Date  K.G. G. 10-21-64 | Performed Date<br>by<br>H.A. Lindwall<br>10-30-64 | Witnessed for Date NAA 10-30 Gy (921) | Verified by USAF |

Fuel Valve

### PROPELLANT VALVE FUNCTIONAL TEST (reference paragraph 6.5)

Oxidizer Valve

| Response Time                           |                              |
|---|------------------------------|
| (AR)                                    | AZZ.                         |
| Ambient Temperature 70 F                | (921) 7 h                    |
| (20.20)                                 |                              |
| Energizing Voltage 26 VDC               | ( vpc                        |
| (26+0.5)                                |                              |
| Inlet Pressure                          | 300 paig                     |
| (300+10 for "pull-in")                  | 1                            |
| Opening Time .005% second               | is (921). O CZ & seconds     |
| (A AAA marimum) AA                      |                              |
| Inlet Pressure                          | ERO psig                     |
| (zero for "drop-out")                   | ds (921). 0076 seconds       |
|   | ds viv. Oo c o seconds       |
| (0.0035 maximum)                        |                              |
| Low Voltage Operation                   |                              |
| ZON TOZOGGO OPOZUATA                    |                              |
| Ambient Temperature 70 P                | $\binom{A^{NR}}{921}$ , $70$ |
| (70+10)                                 | WAT                          |
| Inlet Pressure 300 psig                 | 300 psig                     |
| (300±10 for "pull-in")                  | (APA)                        |
| Opening Voltage 3.0 VDC                 | (27) 5.5 VDC                 |
| (16 maximum) (21)                       | ASA                          |
| Inlet Pressure ZERO psig                | (52) Z ERO paig              |
| (zero for "drop-out") 18 VDC            | (NR) 1.05 VDC                |
| Closing Voltage W/ 18 VDC (1.0 minimum) | (92) 1.(1) N                 |
| (T'O WITHING)                           | W. Carlotte                  |
| Inspection Remarks NONE (32)            | 454                          |

| Prepared by Date Performed by Date | Witnessed for | Date     | Verified   | by USAF  |
|------------------------------------|---------------|----------|------------|----------|
| 16.6 10-21-4 H.a Ludwald           | NAA SING      |          | Variable 1 |          |
| 10-30-64                           | 63 00%        | (21)     | 1          | 10-30-60 |
| 13 33 41                           | 10-78-64      | <u> </u> | <u> </u>   | /        |

DEVELOPMENT LABORATORY TEST REPORT

PAGE

LAB TEST NO. PREPARED BY EWR NO. FACILITY PHONE DATE F. Pope 683369 2061 10-30-64 ENV.LAB PART NO. 407559 TYPE OF TEST Pre-Explosive Atmosphere PART SE7 25# TCA S/N 9193579 Propellant Valve Functional OXIDIZER VALVE CURRENT TRACE (OPENING TIME) Horizontal 0.5 ms/cm Vertical 5 hv/cm 0.0065 sec/max Requirement = 0.0038 sec Actua! VOLTAGE TRACE (CLOSING TIME) 0.5 ms/cm Horizontal Vertical 10 v/cm = Requirement = 0.0035 sec/max 0.0030 sec Actua:

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Form 600-4-67 New 10-63

R-15019-2

DEVELOPMENT LABORATORY TEST REPORT

LAB TEST NO. 638369 PREPARED BY FACILITY PHONE DATE F. Pope ENV.LAB. 2061 10-30-64 TYPE OF TEST Pre Explosive Atmosphere PARTSE7 25# TCA PART NO. 407560 S/N 4059525 Propellant Valve Functional FUEL VALVE CURRENT TRACE (OPENING TIME) 0.5 ms/cm Horizontal .5 mv/cm Vertical 0.0065 sec/max Requirement Actual 0.0036 sec VOLTAGE TRACE (closing time) Horizontal = 0.5 ms/cm Vertical 10 v/cm Requirement = 0.0035 sec/max Actual 0.0026 sec

Form 600\_0-67 New 10-63 278

R-15019-2

| COMPONENT NA  | AME THRUST CHAMBER ASSE     | MBLY - 25# PART NO { MAC 52-52701-265   NAA 208160-61  |
|---------------|-----------------------------|--|
| NAME OF TEST  | EXPLOSIVE ATMOSPHER         |  |
| 7.1.6.2.6     |                             | est (reference paragraph 7.3.3.1) were tested at the following pressure on producing characteristics |
| ;             | Pressure Altitude<br>(feet) | The Propellant Valves Passed the Test (yes or no)  |
| •             | Sea Level to 5000           | الم الم الم الم الم الم الم الم الم الم  |
|               | Sea Level to 10,000         | الأوق  |
| 9 191         | 5000 to 15,000              | V= 5 (918)   |
|               | 15,000 to 25,000            | Y== (918) ¥  |
|               | 35,000 to 35,000            | K-2 (18) N   |
|               | 35,000 to 45,000-           | V= 3 (918)   |
|               | 45,000 to 55,000 (c)        | VES (318)  |
| ·             | Inspection Remarks:         | 72-71116 STARTED ON 11-5-64  |
|               | AT 0945. TESTAK.            | WAS CONDUCTED AT SSFL COMPNENT   |
|               | LAE.                        |  |
|               | ABOVE TESTING               | MARTES 11-5-64 - 14:40 (18)  |
| PREPARED BY   | DATE PERFORMED BY DATE      | WITNESSED FOR HAA DATE CENTIFIED FOR MCDON DATE  |
| R. Cole       | The Main                    | VEDISIED DY USAS CATE  |
| RC. 10-31     | 1-64 11-5-6-1               | 16 King Complete Stranger Stranger   |
| FORM 608-B-39 | NEW 6-63                    | ( )  |
| R-15019-2     |                             | 279  |

| COMPONENT NAI | ME THRUST CHAMBER ASSEMBLY - 25#                           | MAC 52-52701-:265  |
|---------------|--|--|
| NAME OF TEST_ | EXPLOSIVE ATMOSPHERE                                       | PART NO.   NAA 208160-61   |
| 7.1.6.2.7     |  |  |
| 7.4.0.2.7     | Propellant Valve Proof Pressure as paragraph 6.1)          |  |
|               | Proof Pressure   | xidizer Valve Fuel Valve   |
|               | Pressure (500 ±10)   | 500 psig 500 psig  |
| <b>y</b> .    | Time Duration (3 minimum)                                  | 3 minutes  |
|               | Leakage<br>Voltage (26 <sup>±</sup> 0.5)<br>Inlet Pressure | 26 VDC 36 VDC  |
| ·             | (500 ± 10)   | 500 psig 500 psig  |
|               | Time Duration (5 minimum)                                  | 5 minutes 5 minutes  |
| •             | Leakage Rate (2.23 maximum)                                | ∠.1 SCC He  min  min  min  min  min  min  min  mi  |
| ·             | Inspection Remarks   |  |
|               |  |  |
|               |  |  |
|               | ••   |  |
| •             |  |  |
|               |  |  |
|               |  |  |
| PREPARED BY   | DATE PERFORMED BY DATE WITNESSED FOR                       | NAA DATE CERTIFIED FOR MCDONNELL CATE  NAME OF THE PROPERTY OF |
| E. Adams      | 14 Machen 164 11-  | 6-64 VERIFIED BY USAF  |
| FORM 608-B-39 | /_ · · _   _ · · · · · · · · · · · · · ·                   | 1 Roya Ama 194 A   |

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| COMPONENT NA           | ME THRUST CHAMBER ASSEMBLY - 25# PART NO. \[ \begin{array}{ll} MAC & 52-52701-265 \\ NAA & 203160-61 \\ EXPLOSIVE ATMOSPHERE & TEST NO. \( \frac{203160-51}{203160-51} \\ \text{SP-07.} \\ 380 \end{array}   |
|------------------------|--|
| 7.1.6.2.8              | Propellant Valve Electrical Resistance test (reference paragraph 6.3)  |
| <b>.</b> .             | Environmental Temperature(70 ±10F)   |
|                        | Resistance A - B   |
|                        | Oxidizer Valve / Acceptable per Figure 9.  |
| **                     | Fuel Valve (Acceptable per Figure 9.) Yes or No YES  |
| •                      | Resistance C - D (1.0 maximum)   |
|                        | Oxidizer Valve 6. 0.08 ohms  |
|                        | Fuel Valveohms   |
|                        | Inspection Remarks   |
| •                      | NONE   |
|                        | •  |
|                        |  |
| · ·                    |  |
| •                      |  |
|                        |  |
|                        |  |
|                        |  |
|                        |  |
| REPARED BY<br>E. Adams | DATE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR MCDONNELL OF THE MEDICAL OF THE MEDI |

R-15019-2

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| COMPONICHT   | AND THRUS  | ST CHAMBER ASS | SEMBLY - 25#                | 2427 NO (MA                      | c_52-527                            | 01-265                                |
|--------------|------------|----------------|-----------------------------|----------------------------------|-------------------------------------|---------------------------------------|
|              |            | SIVE ATMOSPHER | , ,                         | - PART NO { NA                   | 20216/                              |                                       |
| NAME OF TES  |            |                |                             |                                  | NAME OF TAXABLE PARTY.              | TOF38 <sub>0_</sub>                   |
| 7.1.6.2.9    | paragrap   | op 6.4) .      | Lectric Strengt             | h Test (refe                     | rence                               |                                       |
| •            | •          | •              |                             | r Valve                          | Fuel Va                             |                                       |
|              |            |                | Voltage<br>Volts<br>500 ±10 | Current<br>Microamps<br>500 max. | Voltage<br>Volts<br>500 <u>+</u> 30 | Current<br>Microamps<br>500 max       |
| <b>&amp;</b> | A to Gro   | ound           | 5001                        | 49.41                            | 300V                                | 24 wa                                 |
| •            | C to Gro   | ound           | 5001                        | 49 410 (4)                       | 500V                                | 50-49                                 |
|              | A to C     |                | 5cov                        | 1                                |                                     | 21-4a                                 |
|              | Inspecti   | on Remarks     |                             |                                  | ·                                   |                                       |
| •            |            |                | VENE 6/N.                   | V. / ( 4 841)                    |                                     |                                       |
| :            |            | ·              |                             | · ·                              |                                     | :<br>                                 |
| • • •        |            |                |                             |                                  |                                     |                                       |
|              |            |                |                             |                                  |                                     |                                       |
| •            |            | •              | •                           |                                  | •                                   |                                       |
| •            |            |                |                             |                                  |                                     |                                       |
|              | • •        | •              | . •                         |                                  |                                     | ,                                     |
|              |            | •              |                             | •                                |                                     |                                       |
|              | •          | •              |                             |                                  |                                     | •                                     |
|              |            |                | •                           | •                                |                                     |                                       |
| REPARED BY   | DATE PERFO | i i            | WITHESSED FOR NA            | A DATE CERT                      | IFIED FOR MO                        | DONNELL DA                            |
| E. Adams     | 11904 7.7  | cos- III       |                             | Y/VOV/ VERI                      | FILO BY USAI                        | 1 164                                 |
| ORM 608-B-3  | NEV 6-63   |                |                             |                                  | <del></del>                         | · · · · · · · · · · · · · · · · · · · |

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| AME OF TEST_ | EXPLOSIVE ATMOSPHERE                  | TEST NO. 208160-                        |                 |
|--------------|---------------------------------------|---|-----------------|
| 7.1.6.2.10   | Propellant Valve Functiona            | 1 Test (reference paragra               | ph 6.5)         |
| •            | •                                     | Oxidiser Valve                          | Fuel Valve      |
|              | Response Time                         |   |                 |
| . •          | Ambient Temperature                   | $\binom{A^{N_R}}{Q_1}$ 70° $\mathbf{F}$ | 70° F           |
|              | (70 <u>+</u> 10)                      | (ANR)                                   | )               |
| *            | Energizing Voltage (26 +0.5)          | 26.0 VDC 402                            | VDC VDC         |
|              | Inlet Pressure                        | 300 paig (ATA)                          | 300 psig        |
| •            | (300 ±10 for "pull-in")               | · (4K)                                  | 1               |
|              | Opening Time<br>(0.0065 maximum)      | CO39 second                             | 036 seconds     |
|              | Inlet Pressure                        | ZERO paig Wil                           | ERO psig.       |
| •            | (zero for "drop-out")                 | (ANA)                                   |                 |
|              | Closing Time (0.0035naximum)          | * .0033(4%)                             | 0026 seconds    |
| :            | •                                     | £ .0035(g)                              | •               |
|              | Low Voltage Operation                 | 11/2                                    |                 |
|              | Ambient Temperature                   | 24 70° F (41)                           | 70° F           |
|              | (70 <u>+</u> 10)                      |   | <del></del>     |
| •            | Inlet Pressure (300+10 for "pull-in") | 300 paig 📆                              | 800 psig        |
| •.           | Opening Voltage                       | 67 8.10 VDC (47)                        | 6.0 VDC         |
|              | (16 maximum)                          |   |                 |
|              | Inlet Pressure (zero for "drop-out")  | ZEROpsis WZ                             | ERO psig        |
|              | Closing Voltage                       | (4) 1.85 VDC (4) 1                      | 10 VDC          |
|              | (1.0 minimum)                         |   | <del>_</del>    |
| •            | Inspection Remarks * /N               | ECRUMPIEN ON (S.                        | ILLESIEPE ;     |
|              | ·                                     | A A A A                                 |                 |
| F. I SE      | WHS MIN-INTERPRE                      | TED WIT                                 |                 |
| EPARED BY    |                                       | SEED FOR NAA DATE CERTIFIED             | FOR MCDONNELL O |
| E. Adams     | 10/14 Machine                         | Hart 6/Nov. / D. Nava                   | BY USAF 6/No.   |

DEVELOPMENT LABORATORY TEST REPORT

| PR          | EPARE<br>F                                       | . Po      | ре             |  |     |          |           |  | 9539   |              |              | <del></del>    | <del></del>  |  | E  | VV.  | LA   | В.           |   | рно<br>20  | 61                            | 1  | 1-6   | 64                                    |      |    |
|-------------|--|-----------|----------------|--|-----|----------|-----------|--|--|--------------|--------------|----------------|--------------|--|--|--|--|--------------|---|--|-------------------------------|--|---|---------------------------------------|------|----|
|             |  |           | 25#            |  |     |          | <b>'</b>  | ART  | NO.40  | 75           | 59           |                |              | 1  | TYPI   | OF   | TEST   | Po           | st  | Exp  | los                           | ive  | At  | mos                                   | phe: | re |
| Pro         | pe.  | lla       | at 1           | alv  | 78  | ı        | , IS,     | N (  | 919  | 3579         | 7            | T              | т —          |  | Fun  | cti  | ona  | 1            |   | _  | ,                             |  |   |                                       |      |    |
| <u> </u>    |  |           |                |  |     |          | <u> </u>  |  |  |              |              |                |              |  |  |  |  |              |   |  |                               |  |   |                                       |      |    |
|             |  |           |                |  |     |          |           |  |  | . (          | XI.          | þizi           | ¢R           | VAL  | VΕ   |  |  |              | i   |  |                               |  |   |                                       |      |    |
|             |  |           |                |  |     |          |           |  |  |              |              |                |              | 1  |  |  |  |              |   |  |                               |  |   | . 1                                   |      |    |
| C           | RRI  | ידית      | TR/            | CE   |     |          |           |  |  |              |              |                | - 308        | a special contraction                            | Page 120   | 10 Km  | 7.8 P.   | and the g    |   | 37. E  | -                             | and the  | S 120 19  | (199 <sub>)</sub> , 50                | 2    | _  |
| <b> </b>    | <del>                                     </del> | 1         |                |  |     | _        | _         | -  |  |              | $\vdash$     | 2              |              |  | i i sust<br>I sust                               |  |  |              | # #/<br>* **  |  | 3<br>3<br>7                   |  | 해요<br>항공 :<br>50 : 10 : 10 : 10 : 10 : 10 : 10 : 10 : | 4.224                                 |      | -  |
| <b> _</b> ( | PEI  | IIN       | <del>- T</del> | ME   | }   | <b> </b> | -         | -  |  |              | _            | ŀ              |              |  | •  | * S K  | X.   | ,            | 4 C<br>2 Z  | 1  | 1                             |  | 1   |                                       |      | _  |
| <u> </u>    | <u> </u>   | _         |                |  |     | <u> </u> |           |  |  |              | <u> </u>     | ľ              |              |  |  | - E.   |  | • •          | 4 P<br>4 E<br>8 E   | 10<br>10<br>10<br>10                             |                               |  |   |                                       |      | _  |
| Ho          | iz   | nta       | 1              | =  | 1 r | s/       | em_       |  |  |              | <u> </u>     | į.             |              | . : 1.71   | 4  | . /kg  | 6 y 2  |              | # E<br>18 Mk<br>18 Mk × w   | 1  | المدادة<br>المدادة<br>المدادة | 2  | 1   |                                       |      |    |
| Ve          | tic  | al        |                | 11   | 20  | m        | v/c1      | <u>1</u>   |  |              |              | ľ              |              |  | 9 m ÷ 1.   | 机装置型   | 65.51  | *.* 0 p      | 9 <b>9</b> 11 11<br>11 12 13 13<br>12 14 15 15 15 15 15 15 15 15 15 15 15 15 15 |  | 1.5° 20° 3                    | e - 3,3  | 3771  |                                       |      |    |
|             |  |           |                |  |     |          |           |  |  |              |              | į              |              |  |  | 1  |  | 7            | 2 (C)   |  | . * -                         |  | e ja  |                                       |      | _  |
| Roc         |  | · ome     | nt             |  | 0   | 206      | 5 se      | 4  |  |              |              |                |              |  |  | نعا د_   | رة<br>أنون من                                    |              | 20 k.   |  |                               |  |   |                                       | 1    | -  |
|             | ua   |           | 110            | 1  |     |          | 39 s      |  |  |              | H            |                | و خنیان د    | فشيع وسيع  |  |  | •  |              | N 84  |  |                               |  | al con  | 1                                     |      | ÷  |
| AGI         | ua   | -         |                | _  |     | .00.     | 77 3      | ec   |  |              | $\vdash$     | ٥              |              | i i re   | -  |  |  |              |   |  |                               |  |   | and the second                        |      | _  |
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| VC          | ነፒ.ጥ/  | GE        | TRA            | CE   |     |          |           |  |  |              |              |                | İ            | <del>                                     </del> | <b> </b>   |  |  |              |   |  |                               |  |   |                                       |      |    |
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|             | ·IO  | TINC      | T              | ME   |     | -        |           | <del>                                     </del> |  |              | ┞.           |                |              |  |  | ar vo  | 1  | 79 (<br>78 ( | r<br>F  | ्चुस्थाः<br>इ.स.च्या                             |                               |  | ASSES VIEWS   | -111 <b>-76</b>                       |      | _  |
| 17          | •  | <u> </u>  | _              |  |     | _        | ļ ,       |  | -  |              | -            |                |              |  | ***  |  |  | 3            |   |  |                               |  |   | - 1                                   |      | _  |
|             |  | nte       | Τ              | =  | 0.  | 5 1      | ns/c      | m  | ļ  |              | _            | į              |              |  |  | - 1  |  | -            |   | 6w75ch   | نغة كالتنوي                   |  | easton:   | گانگان بلند<br>ووب و مدر              |      | _  |
| Ver         | tic  | al        |                | =  | 10  | v,       | cm        | <u> </u>   |  |              | L            | l              |              |  |  |  |  | 1            | 1   | منتهه هر<br>مراجعه مر                            | (Frankling)<br>(Frankling)    |  |   |                                       |      |    |
|             |  |           |                |  |     |          |           |  |  |              |              | Ì              |              |  |  | . 12.4   |  |              | 1/  |  |                               |  |   |                                       |      |    |
| Rec         | uir  | eme       | nt             | =  | 0,  | 00       | 35 s      | ec,  | max  |              |              | 3              |              |  |  |  | 1 11   |              |   |  |                               |  |   |                                       |      | _  |
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Form 60017-67 New 10-63 284

R-15019-2

DEVELOPMENT LABORATORY TEST REPORT

LAB TEST NO. PREPARED BY EWR NO. FACILITY PHONE F. Pope 595396 ENV.LAB. 2061 11-6-64 PARTSET 25# TCA TYPE OF TEST Post Explosive Atmosphere PART NO. 407560 Propellant Valve S/N 4059525 Functional HUEL VALVE CURRENT TRACE (OPENING TIME) Hdrizontal 1 ms/cm Vertical 20 my/cm 0.0065 0036 VOLTAGE TRACE (drosing time) 0.5 ms/cm Horizontal Vertical 1d v/cm Requirement = 0.0035 sec/max Actual 0.0026 sec

| COMPONENT NAME _       | THRUST CHAMBER ASSEMBLY - 25# PART NO.   MAC 52-52701-265 208160-61  |  |  |
|------------------------|--|--|--|
| NAME OF TEST           | THRUST CHAMBER ASSEMBLY - 25#  PART NO.     MAC   52-52701-265   |  |  |
| Reference:             | MAC SCD 52-52700, Revision G, Paragraph 6.2.3.18 and 19  |  |  |
| 7.1.7                  | Fuel and Oxidizer Resistance - TCA #1  |  |  |
| ~.1.7.1                | Test Procedure   |  |  |
| 7.1.7.1.1              | Install the oxidizer propellant valve as shown in Figure 12. Close V <sub>10</sub> .   |  |  |
| 7.1.7.1.2              | Attach to the inlet of $V_{10}$ a Nitrogen Tetroxide propellant supply.  |  |  |
| 7.1.7.1.3              | Adjust the propellant supply pressure to 150 ±15 psig.   |  |  |
| 7.1.7.1.4              | Open V <sub>10</sub> . Adjust the DC power supply to 26 +2 VDC. Energize the propellant valve. When propellant (liquid or vapor) appears at the discharge, de-energize the propellant valve.   |  |  |
| 7.1.7.1.5              | Adjust the environmental temperature to 160 ±5 F. When the propellant valve body temperature reaches this temperature record the date and the time on the data sheet. The propellant valve shall be exposed to propellant at the above temperature for a period of two weeks (336 hours).  |  |  |
| 7.1.7.1.6              | Activate oscilloscope to record propellant valve voltage and current traces. (This will require two actuations to obtain the opening and closing responses). Energize the propellant valve with 26 ±2 VDC. When propellant (liquid or vapor) appears at the discharge, de-energize the propellant valve. (As a result the valve "on" time will take place over a relatively short period of time. It is intended this way to avoid problem of disposing of large amounts of propellant). |  |  |
| 7.1.7.1.7              | Repeat paragraph 7.1.7.1.6 three times daily at equally spaced intervals during the two week exposure period.  |  |  |
| PREPARED BY: R. Cole / | DATE APPROVED OR NAA: DATE APPROVED FOR McDONNELL: BATE  |  |  |
| CHECKED BY:            | 11-2-64 Serde 11-2-64  |  |  |

FORM 608-B-38 NEW 6-63

| COMPONENT NAM                           | THRUST CHAMBER ASSEMBLY - 25# PART NO. MAC 52-52701-265  |
|---|--|
| NAME OF TEST_                           | FUEL AND OXIDIZER RESISTANCE TEST NO 208160-SHEET OF 380   |
| 7.1.7.1.8                               | At the end of the two week period close V10 and record the date and the time on the data sheet.  |
| 7.1.7.1.9                               | Attach a GN <sub>2</sub> supply to the inlet of V <sub>10</sub> . Open V <sub>10</sub> and supply $GN_2$ to the propellant valve at 120 +10 psig and 160 +10F. Energize the propellant valve with I2 ±2 VDC for a period of 3 minutes. Then cycle the valve at the same temperature and pressure as follows for ten (10) times, using 26 +1 VDC. |
|   | <ul> <li>(a) 5 ±1 seconds on time</li> <li>(b) 5 ±1 seconds off time</li> <li>Close V<sub>10</sub> and disconnect the GN<sub>2</sub> supply.</li> </ul>  |
| 7.1.7.1.10                              | Attach a Freon TF supply to the inlet of $V_{10}$ . Open $V_{10}$ and supply Freon TF to the propellant valve at 35 to 50 psig. Energize the propellant valve with 12 $\pm 2$ VDC for a period of 3 minutes. Then cycle the valve at the same pressure as follows for ten (10) times, using 26 $\pm 1$ VDC.                                      |
|   | <ul> <li>(a) 5 +1 seconds on time</li> <li>(b) 5 +1 seconds off time</li> <li>Close V<sub>10</sub> and disconnect the Freon TF supply. Repeat paragraph</li> <li>7.1.7.1.9.</li> </ul>   |
| 7.1.7.1.11                              | Remove the propellant valve from the test setup.   |
| 7.1.7.1.12                              | Perform Propellant Valve Electrical Resistance per paragraph 6.3.  |
| 7.1.7.1.13                              | Perform Propellant Valve Functional per paragraph 6.5 on the oxidizer propellant valve at the temperature of paragraph 7.1.7.1.5.  |
| 7.1.7.1.14                              | Perform Propellant Valve Dielectric Strength per paragraph 6.4 on the oxidizer propellant valve at the temperature of paragraph 7.1.7.1.5.   |
| ( • • · · · · · · · · · · · · · · · · · |  |
| PREPARED BY:                            | DATE APPROVED FOR NAA: DATE APPROVED FOR MCDONNELL: DATE   |
| R. Cole REGRED BY:                      | 10-31-69<br>DATE DYS   |

R-15019-2

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| COMPONENT NAME | THRUST CHAMBER ASSEMBLY - 25# PART NO. $\frac{MAC}{NAA} = \frac{52-52701-265}{208160-61}$   |
|----------------|---|
| NAME OF TEST   | FUEL AND OXIDIZER RESISTANCE TEST NO 208160-SHEET OF 380  |
| 7.1.7.1.15     | Perform Propellant Valve Proof Pressure and Leakage per paragraph 6.1 on the oxidizer propellant valve at the temperature of paragraph 7.1.7.1.5.   |
| 7.1.7.1.16     | Perform Propellant Valve Load Analysis per paragraph 6.9 on<br>the oxidizer propellant valve. Adjust the propellant valve<br>body temperature to the temperature specified in paragraph<br>7.1.7.1.5.   |
| 7.1.7.1.17     | Repeat paragraphs 7.1.7.1.12 through 7.1.7.1.15 except that: the environmental temperature of paragraph 7.1.7.1.5 shall be changed to 15 $\stackrel{+}{10}$ F.  |
| 7.1.7.1.18     | Repeat paragraphs 7.1.7.1.1 through 7.1.7.1.16 on the fuel propellant valve except that the propellant as specified in paragraph 7.1.7.1.2 shall be Monomethyl Hydrazine and that the flushing fluid as specified in paragraph 7.1.7.1.10 shall be alcohol. |
|                |   |

PREPARED BY: DATE APPROVED FOR NAA: DATE APPROVED FOR MCDONNELL: DATE

R. Cole Ke 10-31-64

CHECKED BY: DATE

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FORM 608-B-38 NEW 6-63

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SET 25 1 11 165 PROPERTY OF THE PROPERTY OF TH

# IROCKIETIDYIVE INSPECTION DISCREPANCY AND CORRECTION RECORD

**(** ;

4193679 Serial No. 4669525

Dwg. No 52-52701

MAKE ENTRY CLEAR AND CONCISE, USE INK

Model 5'e - 7

|            |              | Mo   | del              | <u></u>        |                               |
|------------|--------------|--|------------------|----------------|-------------------------------|
| DCP        | Ent'd        | DESCRIPTION OF DISCREPANCY AND ACTION TAKEN  | 1                | EARED B        | Y                             |
| No.        | By &<br>Date | 5/   | Mech.            | Lead-<br>man & | Insp.                         |
|            | 11/          | BEER BUTTE YS  | Date             | Date           | Date                          |
| 1          | 0/4          | PART NO. 2345 TEST ON The MMH Value 11/12/   | 14 7             | The            |                               |
| 1          |              | Discharge Was Black  |                  |                |                               |
|            |              | PEplaced "O" clownstream of  |                  | <b>-</b> -,    | -,                            |
| ACT<br>TAK | ION          | Va(lue.  | ·                | 13             | 13                            |
| IAN        | EIN          | •  |                  | 3              | **                            |
| 2          | 1/2          | fire in over sometime between 11:30 c  |                  | 14-            | 1_                            |
|            | 64           | fire in over Sometime between 11:300   | 1 11             | 1              | r                             |
|            | C.F.         | 1:30 check suspect Lask at fitting between the   | MCCN             | -/// c         | ,                             |
| 1.67       |              |  |                  |                | //                            |
| TAK        | ION<br>EN    | FILTERS Replaced & Ring MS-18114-114-washer 2118-011 Seat<br>OFR. 12895 R. ANd. RD 162-3013-0004 G   |                  |                | 104                           |
|            | Ų.           | PART NO. S. FART NO. S. AND ICE - 3013 - WORK G-   |                  | •              | 181                           |
| 3          | 747          | PART NO. 407559 SN 9143579 DYIA value vnable   | to d             | CCOL           | taus                          |
|            | (:)          | value as to para 7.1.7.1.9 to 7.1.7.1.0.   |                  |                |                               |
|            |              |  |                  | /              | -,                            |
| ACT<br>TAK | ION<br>EN    | OFR 12895 R.   |                  | 1//            | 164                           |
|            |              |  |                  | <b>等</b> グ     | <b>*</b> . • .                |
| 4          | 14           | PART NO. 407560 YN 4089515 FUEL VALUE O'RING   | betu             | dee l          | ۲.                            |
|            | 64.          | filters no goods Starting to deterio   |                  |                | N                             |
| [          | (3)          | /<br>/   | 1                | <u> </u>       |                               |
|            | ION          | LEPUNCED WITH HS X8774-114 BIKE UP WASHE, ZIT8-0, TSLA<br>2118-014 ORING, AND RD 262-3003-0004 SEAL. | <u>s</u> - [     | ]              |                               |
| TAK        | EN           | Ref. IL 4388-5219 Cales nar-17-64  |                  | \$ ,9          | ે <sub>લ</sub> ો<br>• • • • • |
|            | 11/          | PART NO S/   | IUGAN,           | 11-1           | 1- 64<br>} \                  |
| 5          | 18/          | 40/360 /N 403 9513 FUEL VALUE GEOGR  | <i>y</i> = . , , | EIT            |                               |
|            | 64           |  | <u>נלתקשו</u>    |                | <del></del>                   |
| !          |              | _ CLosing Voltage 16 (1.0 MAximum) Should be   | (1.0 /           | 11/11.60       | mum_                          |
| ACT<br>TAK | ION<br>EN    | Kef. AND FROM E. ADAMS PATED 11-18-61 TO   | 11-              | 20-            | 22                            |
|            |              | COLLECT TYPE. ERROR ON 11. 4388-5219   |                  | -1/            |                               |
| orm R 2    | 25 Re        | v 12.57 lb-15019-2   |                  | 289            |                               |

919 3579 Serial No. 4059525

INSPECTION DISCREPANCY AND CORRECTION RECORD

Dwg. No. 52 - 5270/

MAKE ENTRY CLEAR AND CONCISE, USE INK

Model SC-7

|            |                       | DESCRIPTION OF DISCREPANCY AND ACTION TAKEN                           | Cl      | EARED B           | Y           |
|------------|-----------------------|---|---------|-------------------|-------------|
| DCP<br>No. | Ent'd<br>By &<br>Date |   | Mech.   | lead-<br>man &    | Insp.<br>&  |
|            |                       | BEER BUTTE YS   | Date    | Date              | Date        |
| Ь          | 114                   | PART NO. 407559 SIN -9193579- N.T.O Value - GNZ                       | LEQ     | K                 |             |
| . (        | 64<br>63              | check at isops: - Leaked between fil                                  | ter     | <u> </u>          |             |
| ACT<br>TAK | ION                   | Replaced O" RING as per EWR 625800                                    |         | TO THE            | 1/2/00      |
| 1          | 7014                  | PART NO. (TENERAL No pictures in DAT BOOK                             | AS      | PEK               | 2           |
|            | (3)                   | Spec 208160-401 PARA.6.   |         |                   |             |
| 467        |                       | 7   | 11      | 27                | 64          |
| TAK        | EN                    | INFO-ONLY   |         |                   |             |
|            | (%)                   | PART NO. GENERAL - NO PICTURE ON M                                    | M H     | = 01              | osiix       |
| 8          | 12/2/                 | (VOLINGE) DUE TO A MISUNDERSTANDIN                                    | v g     | Belo              | UFCA        |
|            | 64                    | (VOLLAGE) DUE TO A MISUNDERSTANDIN<br>OSS. OPERATOR & STAND. TOLKER _ | 172     | ٦-5-              | 164         |
| ACT<br>TAK | (EN                   | TNFO-ONLY   |         | (3)               | <b>3</b>    |
| 4          | 12/9                  | PART NO. UNABLE TO PURGE N. TO VALUE PER PARA 7.1.7.1                 | زه که و | / Tin             | עה ט        |
| 7          | 4                     | AS TO PARA 7.1. 7.10 Flow satisfactory, repeated.                     |         |                   |             |
| <u> </u>   | (·)                   | ENzipurge Satisfactory  | -<br>   | [. <del>2</del> - | DE -        |
| AC'<br>TAK | TION                  | CN2-purge Satistactory.   |         | 19 600            | 64          |
|            | Ī.                    | PART NO.  |         | <u> </u>          | <del></del> |
|            |                       |   |         |                   |             |
|            |                       |   |         |                   |             |
|            | TION<br>KEN           |   | -       |                   |             |
| Form R     | 25-1 6                | Rev. 12.57 290  |         | -15019            | 2           |

### ROCKETEDYNE A DIVISION OF NORTH AMERICAN AVIATION INC

### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT NAME  | THRUST CHAMBER ASSEME     | BLY -25# PART NO | MAC 52-52701-265 |
|-----------------|---------------------------|------------------|------------------|
| COMPONENT NAME. |                           | TAIN NO.         | L NAA_208160_61  |
| NAME OF TESTFI  | WEL AND OXIDIZER RESISTAT | MCE TEST NO.     | _208160.5HEETOF  |

#### Deviation Reuest:

It is hereby authorized to accept the following deviations to the resistance testing. (Paragraph 7.1.7)

- (1) Change the temperature of the GN<sub>2</sub> to 160 ±20° F. Reference paragraph 7.1.7.1.9.
- (2) Decontaminate both propellant valves as per paragraphs 7.1.7.1.9 and 7.1.7.1.10 prior to resistance testing. (Fluid for fuel propellant valve called out in paragraph 7.1.7.1.18).

Recopied from original request dated 9 November 1964.

R.Cole

Gemini Dat-Rat Unit

James D. Mayrogenis

MAC Engineering

12-18-14

FORM 608-B-37 NEW 6-63

R-15019-2

IL 4388-5219

INTERNAL LETTER

North American Aviation, Inc.

DATE

17 November 1964

TO Address Those Concerned

FROM Address Gemini DAT-RAT Unit

D/896-388

SUBJECT

SE7 25 lb TCA, DAT Unit #1, Propellant Valve, P/N 407560, S/N 4059525

Due to an improper facility test setup during the propellant resistance testing of the subject valve there exists a possibility of contaminants. in the valve.

The following steps shall be undertaken to insure the valve is still in acceptable operating condition and to preclude a similar occurance.

- Disassemble test facility filter assemblies and install proper seals.
- Flush propellant valve as per paragraphs 7.1.7.1.9, 7.1.7.1.10 and 7.1.7.1.18 in DAT specification 208160-401.
- Perform the propellant valve functional, paragraph

Pertinent procedure directives will be enclosed to assure compliance with the steps described.

Upon satisfactory completion of the above resumption . of the fuel resistance test will take place.

Gemini DAT-RAT Unit

Approved:

G. Eide Supervisor

Gemini DAT-RAT Unit

MAC Engineering

The fuel propellant valve was flushed per 7.1.7.1.9, 7.1.7.1.10 and 7.1.7.1.18 \_\_\_\_\_\_ (yes or no). Fuel Valve Response Time Ambient Temperature (70 + 10)26.0 VDC Energizing Voltage  $(26 \pm 0.5)$ 300 psig Inlet Pressure 300 +10 for "pull-in") ()pening Time 0.0036 seconds (0.0065 maximum) Leto psig Inlet Pressure (zero for "drop-out") 0.00165 seconds Closing Time (0.0035 maximum) Low Voltage Operation Ambient Temperature (70 + 10)psig Inlet Pressure (300 ±10 for "pull-in") VDC Opening Voltage (16 maximum) Inlet Pressure (zero for "drop-out") Closing Voltage (1. minimum) Inspection Remarks Nowe Witnessed for NAA: Date Prepared By: Performed By: Date: Date: Estate 11-17-64 7. T. Dope 11-18-64 Verified By USAF: Date: 18 NOV 64 Rev. A. D. Marrie Date 12-16-64

DEVELOPMENT LABORATORY TEST REPORT

LAB TEST NO. \_ PREPARED BY PACILITY PHONE DATE 5953% F. Pope ENV.LAB. 2061 11-18-64 PART NO. 407560 TYPE OF TEST Post Flush Propellant PART SE7 25# TCA S/N 4059525 Valve Functional FUEL VALVE REFERENCE: II 4388-5219 Lated 17 November 1964 CURRENT TRACE (OPENING TIME) 1 ms/cm Horisbntal /ertical 10 mv/cm 0.0065 sec/max Requirement = 0.0036 sec Actual VOLTAGE TRACE (closting time) Horizontal 0.5 ms/cm Vertical 10 v/cm Requirement = 0.0035 sec/max ctua 0.0026 sec

R-15019-2

Form 600\_u\_67 New 10-63

#### ROCKETDYNE A DIVISION OF NORTH AMERICAN AVIATION, INC.

IL 4388-5239

INTERNAL LETTER

North American Aviation, Inc.

DATE

23 November 1964

TO Address Those Concerned

FROM

Gemini DAT-RAT Unit

Address

D/896-388

SUBJECT

SE7 25 1b TCA Unit #1 Oxidizer Propellant Valve.

P/N 407559, S/N 9193579

REFERENCE

(a) OFR 12895

An investigation of the reported failure (reference a) of the subject valve during the propellant resistance test indicates a facility malfunction rendered on erroneous representation of the units operability.

It is proposed that the subject unit resume testing upon successful completion of the following:

- Rebuilding of a new test setup compatible with NTO.
- Performing propellant valve functionals 6.1, 6.3, 6.4 and 6.5 from DAT specification 208160-401. (Data sheets will be supplied for recording the results.)

P.Q.C

R. A. Cole Gemini DAT-RAT Unit

Approved:

R. G. Eide Supervisor

Gemini DAT-RAT Unit

W. Smith 1/23/64 Supervisor

Propellant Valves

ance D. Manreacuis J. Mavrogenis

MAC Engineering

| •   | Oxidizer Valve        |             | • |
|---|-----------------------|-------------|---|
| Proof Pressure  | - 1                   |             |   |
| Pressure<br>(500 +10)                                     | 500 psig              |             |   |
| Time Duration (3 minimum)                                 | minutes               |             |   |
| Leakage<br>Voltage (26±0.5)<br>Inlet Pressure<br>(500 ±10 | 2 6 VDC<br>5 0 0 psig |             |   |
| Time Duration (5 minimum)                                 | minutes               |             |   |
| Leakage Rate<br>(2.23 maximum)                            | < ./ SCC He min       |             | • |
| Inspection Remarks _                                      | NONE                  |             |   |
|   |                       | <del></del> |   |
|   |                       |             |   |

| •               | Oxidizer                            | Valve                      |
|-----------------|-------------------------------------|----------------------------|
|                 | Voltage<br>Volts<br>500 <u>+</u> 10 | Current Microamps 500 max. |
| A to Ground     | 500                                 | -68 (3) (S)                |
| C to Ground     | 500                                 | 50                         |
| A to C          | 500                                 | 18 3 N.                    |
|                 |                                     | • •                        |
| Inspection Rema | rks Non                             | ξ                          |
| Inspection Rema | rks Non                             | €                          |
| Inspection Rema | rks <u> </u>                        | €                          |
| Inspection Rema | rks <u>Norl</u>                     | €                          |
| Inspection Rema | rks <u>Norl</u>                     | €                          |
| Inspection Rema | rks Non                             | €                          |
| Inspection Rema | rks Non                             | €                          |

| Propellant Valve El paragraph 6.3) | lectrical Resistance test (reference              |
|------------------------------------|---|
| Environmental Tempe                | erature 74 (70+10 P)                              |
| Resistance                         | A - B   |
| Oxidizer Valve                     | 4/ offins (Acceptable per Figure 9, yes or no Yes |
| Resistance (                       | C - D (1.0 maximum)                               |
| Oxidizer Valve                     | 128 ohms (3)                                      |
| Inspection Remarks                 | NONE  |
|                                    |   |
|                                    |   |
|                                    |   |
|                                    |   |

### Propellant Valve Functional test (reference paragraph 6.5)

#### Oxidizer Valve

| response 1 mme                          |                     |
|---|---------------------|
| Ambient Temperature<br>(70 +10)         | 68 F O LOZE         |
| Energizing Voltage                      | 26_vdc 3            |
| (26 ±0.5)<br>Inlet Pressure             |                     |
| (300 ±10 for "pull-in" Opening Time     | 0039 seconds        |
| (0.0065 maximum)                        | OZE OZE             |
| Inlet Pressure<br>(zero for "drop-out") | psig (              |
| Closing Time<br>(0.0035 maximum)        | . 0033 seconds (63) |
| Low Voltage Operation                   | <u>.</u>            |
| Ambient Temperature                     | 68 F 3 X            |
| (70 ±10) Inlet Pressure                 | _300 psig (5)       |
| (300+10 for "pull-in") Opening Voltage  | 9 VDC (3)           |
| (16 maximum) Inlet Pressure             | O psig              |
| (zero for "drop-out")                   |                     |
| Closing Voltage (1.0 minimum)           | VDC (F)             |
| Inspection Remarks                      | NOHE                |

#### DEVELOPMENT LABORATORY TEST REPORT

LAS TEST NO. \_ PREPARED BY EWR NO. FACILITY PHONE - DATE F. Pope 683369 ENV. LAB. 2061 11-23-64 PART SE7 25# TCA PART NO. 407559 TYPE OF TEST Pre Oxidizer Resistance Propellant Valve S/N 9193579 Functional **DXIDIZER** VALVE IL 4388-5239 Dated 23 November 1964 REFERENCE: CURRENT TRACE (DPENING TIME) Horizontal = 1 ms/cm 10 v/cm Vertical Requirement 0.0065 sec/max Actual 0.0039 sec VOLTAGE TRACE (CLOSING TIME) Horizontal = 0.5 ms/cm Vertical 10 v/cm Requirement = 0.0035 Sec/Max Actual 0.0033 Sec

Form 600-W-67 New 10-63 300

R-15019-2

| ·  |                                    |                          |                                 |
|--|------------------------------------|--------------------------|---------------------------------|
| COMPONENT NAM                                | ETHRUST CHAMBER ASSEM              | BLY - 25# PART NO.       | MAC <u>52-52701-265</u>         |
| NAME OF TEST                                 | FUEL AND OXIDIZER RE               | SISTANCE TEST NO 2       | 08160-401 89.13<br>SHEET OF 380 |
|  |                                    |                          | Office Control of 200           |
| 7.1.7.2                                      | Test Data - TCA /1                 | .•                       |                                 |
| 7.1.7.2.1                                    | Component Identifica               | tion                     |                                 |
|  | Component Name                     | Oxidizer<br>Valve        | Fuel<br>Valve                   |
| *  | Rocketdyne Part No.                | 407559                   | 407560                          |
| •  | Component Serial No.               | 9193579                  | 4059575                         |
| 7.1.7.2.2                                    | Fuel and Oxidizer Re               | sistance test (reference | paragraph 71.7.1)               |
| •  |                                    | Oxidizer Valve           | Fuel Valve                      |
|  | Start of Exposure (date and Time)  | (2)-25-4-10:30 A         | M 11-23-4-12:30 PM              |
|  | Environmental Temp. (169 +5)       | € 160 + 5 F              | 160 = 2                         |
|  | Propellant Temp. (160 ±5)          | € 160+5 F                | 160+5                           |
| • .  | End of Exposure<br>(date and time) | 12-9-6-4-10:30           | RM 12-7-64 1:45-PM              |
|  | (dave and only)                    |                          |                                 |
|  | <b>}</b>                           |                          |                                 |
| •  | •                                  |                          |                                 |
|  | •                                  | •                        |                                 |
| PREPARED BY DE R. Cole  **R. Cole  **P. Cole | PN 122 147/4                       |                          | ERTIFIED FOR McDONNELL DATE     |

R-15019-2

FORM 600-8-39 NEW 6-63

| COMPONENT NAME       | THRUST CHAMBER ASSEMBLY - 25# PART NO. \ MAC 52-52701-265  |
|----------------------|--|
| NAME OF TEST         | FUEL AND OXIDIZER RESISTANCE TEST NO. 208160-61  SHEET 89.16780  |
|                      | FUEL AND OXIDIZER RESISTANCE TEST NO. 208160-401 89.1% 10F380  |
| 7,1.7.2.2            | Oxidizer valve actuation checkoff  |
|                      | Date 8AH 11/12-4  1 1/-12-4  2 1/-12-4  3 1/-12-4  3 1/-12-4  5 1/-12-4  6 1/-10-4  7 12-1-64  Date 8AM 1-24  11/2-2-4  11/2-2-4  11/2-2-4  Fuel Valve actuation checkoff  07:15 15:15 13:15  Date 8AM 4-24  Date 8AM 4-24  14-15-14  Date 8AM 4-24  14-15-14  14-15-14  |
|                      | 2   -2+4   9   -1-4   10   -2-4   11   -2-4   12   -2-4   13   -2-4   13   -2-4   13   -2-4   14   -2-4   17   -2-4   -2- |
|                      | MONE 12-9-64163  |
|                      |  |
|                      |  |
| PREPARED BY DATE     | PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR MCDONNELL DATE  |
| R. Cole  RC 10-31-64 | The state of the s |
| ORM 608-B-39 NEW 6   | -63  |

| <u>.</u>                                    | r MAC 52-52701-265       |
|---|--------------------------|
| COMPONENT NAMETHRUS: CHAMBER ASSEMBLY-25#   | PART NO. { NAA 208160-61 |
| NAME OF TEST _ FUEL AND OXIDIZER RESISTANCE |                          |

#### Deviation Rquest:

It is hereby authorized to accept the following deviation to the decontamination procedure for NTO propellant valve S/N 9193579. The deviation occurred during paragraph 7.1.7 1.9 as an apparent obstruction in the facility test setup stopped GN<sub>2</sub> flow. When Freon was introduced there was flow through the propellant valve and the rest of the dec ntamination was followed.

Recopied from original request dated 9 December 1964.

R.Cole

Gemini Dat-Rat-Unit

James D. Marrogenis
MAC Engineering

12-18-14

FORM 608-B-37 NEW 6-63

| COMPONENT NA          | ME THRUST CHAMBER ASSEMBLY - 25# PART NO. MAC 52-52701-265                 |
|-----------------------|--|
| NAME OF TEST_         | FUEL AND OXIDIZER RESISTANCE TEST NO. 208160-SHEET OF 390                  |
| 7.1.7.2.3             | Propellant Valve Electrical Resistance test (reference                     |
| 1.1.1.2.5             | paragraph 6.3)   |
|                       | Environmental Temperature 70 (70 ±10F)                                     |
|                       | Resistance A - B   |
| •                     | Oxidizer Valve Acceptable per Figure 9.                                    |
|                       | Fuel Valve 42.3 ohms (Acceptable per Figure 9.                             |
| ••                    | Resistance C - D   |
|                       | Oxidizer Valve (1.0 maximum)   |
|                       | Fuel Valve .07 ohms  |
|                       |  |
|                       | Inspection Remarks  None 12-13-64  |
|                       |  |
| •                     |  |
|                       |  |
|                       |  |
| ·                     | •  |
|                       | •  |
|                       |  |
|                       |  |
|                       |  |
| 20501000              |  |
| PREPARED BY  E. Adams | DATE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR MCDONNELL CATE |
| -CA 11                | VERIFIED BY USAF   |
|                       | 12.10.64   |

FORM 608-B-39 NEW 6-63

D

| i<br>it       |  | •                                |                          |
|---------------|--|----------------------------------|--------------------------|
| COMPONENT NAI |  | PART NO { NAA_                   | 2-52701-265<br>208160-61 |
| NAME OF TEST_ | FUEL AND OXIDIZER RESISTANCE   | TEST NO. 208160-                 | SHEET -16 380            |
| 7.1.7.2.4     | Propellant Valve Functional Test   |                                  |                          |
|               | e de la companya de | Oxidizer Valve                   | Fuel Valve               |
|               | Response Time  | (M)                              | ( in                     |
| · · · · ·     | High Temperature   | 160° F                           | 160° F                   |
|               | (160±5)<br>Energizing Voltage  | 26 VDC (SII)                     | 26 VDC                   |
|               | (26 ±0.5) Inlet Pressure   | 300 psig (4)                     | 300 psig 34              |
|               | (300 ±10 for "pull-in") Opening Time (0.0065 maximum)  | .0050 seconds                    | 0038 seconds             |
|               | Inlet Pressure   | ZERO paig (ANR) Z                | ER o paig                |
|               | (zero for "drop-out") Closing Time (0.0035maximum)   | .cojo seconds 341                |                          |
|               | Low Voltage Operation  |                                  |                          |
|               | High Temperature (160+5)   | 140° F (21)                      | 160° F                   |
| •             | Inlet Pressure (300+10 for "pull-in")  | $300$ psig $\binom{A^{N}K}{941}$ | 300 psig                 |
|               | Opening Voltage (16 maximum)   | 10.5 VDC (AND)                   | 7.0 vdc 4                |
|               | Inlet Pressure (zero for "drop-out")   | Zero psig                        | FRC psig                 |
|               | Closing Voltage (1.0 minimum)  | 2.5 VDC                          | 4 VDC                    |
|               | Inspection Remarks   | PEC. ( GAR)                      |                          |
| PREPARED BY   | DATE PERFORMED BY DATE WITNESSED, FO   | R MA DATE CERTIFIED              | FOR McDONNELL DATE       |
| E. Adams      | 14 7. Z. Oaper 1 14  | Bre RAIL                         | EVISA DATE               |
| · ·           | 12-10-64   | 75 (41)                          | 10 pec 64                |

FORM 608-B-39 NEW 6-63

DEVELOPMENT LABORATORY TEST REPORT

|  |  |  | LAB TEST NO.   |  |  |  |  |
|--|--|--|--|--|--|--|--|
| PREPARED BY                                      | EWR NO.  | FACILITY DNIV TAD  | PHONE DATE 2061  |  |  |  |  |
| F. Pope  | 5953%<br>  PART NO. 407559   | ENV.LAB.   | 2061 12-10-64  |  |  |  |  |
| Propellant Valve                                 | S/N 9193579  | Type of Test Post  | Oxidizer Resistance  |  |  |  |  |
| Tioperiano vario                                 | <b>3/</b> 11   | Functional   |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  | OXIDIZER VA  | UVE  |  |  |  |  |  |
|  | ENVIRONMENTAL TEMP   | ERATURE 160F   |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| CURRENT TRACE                                    |  |  |  |  |  |  |  |
| (DPENING TIME)                                   | 200  |  |  |  |  |  |  |
| OIBOING TENS                                     | Control de la co |  |  |  |  |  |  |
|  |  | A4 &   |  |  |  |  |  |
| Horizontal = 1 ms/cr                             | <del>                                      </del>  | The state of the s | Service of the Servic |  |  |  |  |
| Vertical = 10mv/cr                               | m i i  | and the second   | //   |  |  |  |  |
|  |  |  |  |  |  |  |  |
| Requirement = 0.00                               | 065 sec/max  | La Brand Lave  | Company of the compan |  |  |  |  |
|  | 050 sec  | 3 (** ) ** ) ** ) ** ) ** ) ** ) ** ) **   |  |  |  |  |  |
| ACCURATE - 0.00                                  |  |  |  |  |  |  |  |
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|  |  | 1 1 1 1  |  |  |  |  |  |
| VOLTAGE TRACE                                    |  |  |  |  |  |  |  |
| (CLOSING TIME)                                   |  |  |  |  |  |  |  |
| VOLUME TIME                                      |  |  |  |  |  |  |  |
|  | The second section of the section of the section | The section of the se | A Design of the control of the contr |  |  |  |  |
| Horizontal = 0.5 ms                              | (_111 B  | Conservation of the second   |  |  |  |  |  |
| Vertical = 10 mv/                                | 'cm  | 第 8公<br>第 8公<br>第 8日   | A A M A STEEL A A A STEEL A A A A A A A A A A A A A A A A A A  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| Requirement = 0.0                                | 015 dec/mark   | en a la comita decima de Santand en en en en en en en en en en en en en  |  |  |  |  |  |
|  | 030 sec  |  |  |  |  |  |  |
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|  |  | 1 1 1 1  |  |  |  |  |  |

Form 600\_17\_67 New 10-63

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R-15019-2

#### DEVELOPMENT LABORATORY TEST REPORT

PAGE\_\_\_\_OF\_\_\_

|                      |              |     |             |              |              |  |                  |          |  |             |              |  |   |  |          |          |            |  |                           |              | NO   |  |              |              |
|----------------------|--------------|-----|-------------|--------------|--------------|--|------------------|----------|--|-------------|--------------|--|---|--|----------|----------|------------|--|---------------------------|--------------|--|--|--------------|--------------|
| PREPARI              |              |     |             |              |              | 1  | EWR N            |          |  |             |              |  | T   | FACI                                     | LITY     |          |            |  | PH                        | ONE          | - 1  | DATE   |              |              |
| F.Pc                 | pe           |     |             |              |              | _ 5  | 953              | 96       |  |             |              |  | _   | ENV                                      | .LA      | B        |            |  | 206                       | <u>51</u>    |  | 12-  | 10-6         | 54           |
| ART S                |              |     |             |              |              | 1  | ART              | NO. 4    | 0756   | 60          |              |  | Ì   | TYP                                      | OF       | TEST     | Pos        | st I   | ue.                       | L Re         | esi  | sta  | nce          |              |
| Pro:                 | 11رز         | ant | Va          | lve          |              |  | S/N              | 40       | 595  | 25          |              |  |   | Fu                                       | nct      | ior      | al         |  |                           |              |  |  |              |              |
| Ī                    |              |     |             |              |              |  |                  |          | ĮΤ   |             |              |  |   |  |          |          |            |  |                           |              |  |  |              |              |
|                      | †            | 1   | <del></del> | ┢            | -            | <del>                                     </del> | $\vdash$         |          | 1  | T           | UEL          | 37.6                                   | TVE   |  |          | -        |            | ├  | $\vdash$                  | <del> </del> | <del> </del>   | ╁┈╴  | ├            | <del> </del> |
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|                      | <u> </u>     |     |             |              |              |  | EM               | VIR      | DNM  | ראי         | AF.          | Mari                                   | PER   | _<br>ΔጥΠ                                 | RE       | 160      | Er.        |  | l                         | İ            |  | 1  | 1            |              |
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| CURF                 | ENT          | TR  | ACE         | ļ            | <u> </u>     | <u> </u>   |                  |          | 11   | _           |              |  |   |  |          |          |            |  |                           |              |  |  |              |              |
| (PPE                 | nin          | G T | IME         | <b>)</b>     |              |  |                  | 1        |  |             |              | de district                            | · · · · · · · · · · · · · · · · · · ·   | 12                                       | E Par    | Street P |            | 177  | 70                        | 37 T.        | and the  |  |              |              |
|                      |              |     |             |              |              |  |                  |          |  | -           | ţ            |  |   |  | 4        |          |            | 11   |                           |              |  | 4 6  | ें अं 👯      |              |
| $\dashv$             | +-           | -   |             | _            | -            | ╁──  | <u> </u>         |          |  | _           | T.           |  |   |  |          |          |            |  | العاظة ا                  |              |  | 100  | 4 (E-4)      | 1            |
| <u>Hþri</u>          | kon          | tal | =           | 1            | ns/          | cm_  |                  |          |  | _           | 11           |  |   |  |          |          |            | i de la companya de l | تد گیم                    |              | - maria  |  |              |              |
| Vert                 | ica          |     | =           | 10           | mv/          | cm   |                  |          |  |             | a. Maria     |  |   |  |          |          |            | 7  | er Vi                     |              |  |  | 1 4          |              |
|                      |              |     |             | <u>`</u>     |              | <u> </u>   |                  |          | $\Box$   | _           | į            |  |   |  |          |          |            |  |                           |              | ** ** *  | - 24 P   | w %          |              |
|                      | $\vdash$     | -   |             | <del> </del> | -            | -  |                  | <u> </u> | <del>                                     </del> | -           |              |  |   |  |          | **       | 11         | er<br>Ee   |                           |              |  |  |              |              |
| Requ                 | ire          | men | t =         | 0.           | <u> 2006</u> | 5 s  | ec/              | max      |  | _           |              |  |   |  | - 16 mm  | , 🤊      | ,          |  |                           |              |  | i ar ober are                                    |              |              |
| Actu                 | 41           |     | =           | 0.           | роз          | 3 s  | ec.              |          |  |             | 1            |  | فيمعتف إأر  | المنطقة المنظم<br>المنطقة المنظم         |          | 71.5     |            |  |                           |              |  |  |              |              |
| T                    |              |     |             |              |              |  |                  |          |  | _           |              | ************************************** | general de<br>Granda<br>Santa de  | المستويد المراس                          | de       | Wales of | تعقره بريم | Harrien en   | ر.<br>نعا <b>ندی</b> رازن | المناوية     | نعاف جيدي والجي  | energy.  |              |              |
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| 4-                   |              |     |             | ļ            | <u> </u>     |  |                  |          |  |             |              |  |   | <b></b>                                  |          | <u> </u> | <b></b>    | <u> </u>   | <u> </u>                  | <b> </b>     | <b>_</b>   | <b>-</b>   | ·            | <u> </u>     |
|                      |              |     |             |              | İ            |  |                  |          |  |             |              |  |   |  |          |          |            |  |                           |              |  |  |              |              |
|                      |              |     |             |              |              |  |                  |          |  |             |              |  |   |  |          |          |            |  |                           |              |  | $\vdash$   |              |              |
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| VOLT.                | AGE          | TR  | CE          |              |              |  |                  |          |  |             | 1            |  |   |  |          | I        | i          | I  | l                         | i            | 1  | 1  | 1            | 1            |
|                      |              |     |             |              | I .          |  |                  |          |  |             |              |  |   |  |          |          |            |  |                           |              |  |  |              |              |
|                      | 1            |     |             |              |              |  |                  |          |  |             | 100          | 200                                    | in the second   | **************************************   | District |          |            | A 220  |                           |              | Sec. 35.00   | · E-sans   | TI TOO       |              |
| (clo                 | 1            |     |             |              |              |  |                  |          |  | _           |              |  |   |  |          |          |            | 1  |                           |              |  |  |              |              |
| (CLO                 | SIN          | G T | ME          |              |              |  |                  |          |  | _           |              |  |   |  |          |          | ·          | ADDRESS STATE  |                           |              |  |  |              |              |
|                      | SIN          | G T | ME          | )            | .5           | ms,  | /cm              |          |  | _<br>_      |              |  |   |  |          |          |            | 1/2  |                           |              | Andreas A  |  | ad is a      |              |
| (CLO                 | SIN<br>zon   | G T | ME          | 0            |              | ,  | /cm              |          |  | -<br>-      |              |  |   |  |          |          |            |  | 1                         |              | and the second   | 69-38-3<br>6-1-1-1<br>58-7-1                     |              |              |
| (CLO                 | SIN<br>zon   | G T | ME<br>=     | 0            |              | ms,  | /cm              |          |  | _           |              |  |   |  |          |          | . Transmit |  | 1                         |              | - 19 G &   |  |              |              |
| (CLO<br>Hori<br>Vert | SING<br>zon  | al  | (전) II II   | 0 10         | ) <b>v</b> , | /cm  |                  |          |  | -<br>-<br>- |              |  |   |  |          |          | . Transmit |  | 1                         |              | - 19 G &   |  |              |              |
| (CLO                 | SING<br>zon  | al  | (전) II II   | 0 10         | ) <b>v</b> , | ,  |                  | max      |  |             |              |  |   | e i me i                                 |          |          |            |  |                           |              | and the first  |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | ma       | <b>x</b>   |             | f. Lyn       |  | n garage  | en en en en<br>La sessión                |          |          |            |  |                           |              | and the second   |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | (전) II II   | 0 10         | ) <b>v</b> , | /cm  | sec,             | max      | <b>x</b>   |             | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | max      | <b>x</b>   |             | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | /max     | <b>C</b>   |             | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | /max     | <b>x</b>   | -           | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | /max     | <b>X</b>   | -           | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | /max     | <b>x</b>   | -           | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | /max     | <b>S</b>   | -           | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | /max     | <b>X</b>   | -           | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | /may     | <b>C</b>   | -           | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | /max     | <b>x</b>   |             | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | /max     | <b>S</b>   | -           | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | /may     | <b>C</b>   | -           | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | /max     | <b>x</b>   |             | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |
| (CLO<br>Hori<br>Vert | zon<br>ica:  | al  | 图           | 0 10         | ) <b>v</b> , | /cm<br>35 :                                      | sec,             | /max     | <b>S</b>   |             | f. Lyn       |  | المجاهد مدر المدار الم | en en en en en en en en en en en en en e |          |          |            |  |                           |              | and the first state of the stat |  |              |              |

### ROCKETDYNE A DIVISION OF NORTH AMERICAN AVIATION, ING

# DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

|               |  | 52-52701-265   |
|---------------|--|--|
| COMPONENT NA  | THRUST CHAMBER ASSEME  | LY - 25# PART NO. MAC 208160.61  |
|               | THE AM OVER TURN NEW   | · · · · · · · · · · · · · · · · · · ·  |
| NAME OF TEST. | FUEL AND OXIDIZER RES  | ISTANCE: TEST NO 208160 SHEET 0F380  |
| 71.7.2.5      | Propellant Valve Dielect paragraph 6.4)  | ric Strength Test (reference   |
| T             | •  | Oxidizer Valve   Fuel Valve .  |
| )             |  | Voltage Current Voltage Current  |
|               |  | Volts Microamps Volts Microamps  |
| .  -          |  | 500 ±10 500 max.   500 ±10 500 max   |
|               | A to Ground  | 500 87/ 1000 010   |
| *             | C to Ground  | 500 \$52 352   |
|               | A to C   | 500 0017   |
|               | High Temperature (160 +5   | 160° F (40) 160° F   |
| •             | Inspection Remarks   |  |
|               | NONE DE  | (41)   |
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| PREPARED BY   | DATE PERFORMED BY DATE WIT   | NESSED FOR NAA DATE CERTIFIED FOR MCDONNELL PATE   |
| -ex- 1        | the les  | VERIFIED BY USAF DATE  |
| E. Adams      | 7. E. Pope   | VERIFIED BY USAF DATE  |
|               | 12.10.64   | (ANR (SA) (SA)   |
| FORM 608-B-39 | NEW 6-63   |  |

| COMPONENT NA                          | ME   |
|---------------------------------------|--|
| NAME OF TEST_                         | FUEL AND OXIDIZER RESISTANCE TEST NO 203160-401 89.18 SHEET OF 380   |
| 7.1.7.2.6                             | Propellant Valve Proof Pressure and Leakage test (reference paragraph 6.1)   |
| *.                                    | Proof Pressure High Temperature (160 ±5) 200 psig  Pressure (500 ±10)  Oxidizer Valve Fuel Valve  Fuel Valve  Fuel Valve  Fuel Valve  Fuel Valve  Fuel Valve  Fuel Valve  Fuel Valve  Fuel Valve  Fuel Valve  Fuel Valve  Fuel Valve  Fuel Valve  Fuel Valve   |
| <b>:</b>                              | Time Duration 3 minutes 3 minutes (3 minutes   |
| •                                     | Leakage Voltage (26± 0.5)  Inlet Pressure  (500±10)  VDC   V |
|                                       | Time Duration 5 minutes 5 minutes (5 minimum)  |
| •                                     | Leakage Rate (2.23 maximum)  Zerosco He  Zerosco He  min  min  |
|                                       | Inspection Remarks NOINE 19/DEC. (6)   |
|                                       |  |
| •                                     |  |
| • • • • • • • • • • • • • • • • • • • |  |
| E. Adams                              | DATE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR MCDONNELL DATE   |
| 5/29<br>FORM 608-8-39                 | 100 miles 100 mi |

R-15019-2

| COMPONENT NAME    | THRUST CHAMBER ASSEMBLY - 25./ PART NO MAC 52-52701-265  |  |  |  |  |
|-------------------|--|--|--|--|--|
| NAME OF TEST      | FUEL AND OXIDIZER RESISTANCE TEST NO. 208160-61 PAR |  |  |  |  |
| 7.1.7.2.7         | Propellant Valve Load Analysis Test - Oxidizer Valve (reference paragraph 6.10   |  |  |  |  |
|                   | Oxidizer valve body temp   |  |  |  |  |
|                   | GN <sub>2</sub> supply pressure 300 (300+10) psig.   |  |  |  |  |
|                   | Power consumption (steady state)   |  |  |  |  |
| *.                | Current Voltage Power  |  |  |  |  |
| •                 | 20 VDC   |  |  |  |  |
|                   | 22 VDC <u>.45(05)</u> <u>22(05)</u> <u>9.90(05)</u> (20 watts maximum)   |  |  |  |  |
|                   | 24 VDC <u>. 48 (65)</u> 24 (65) 11. 52 (20 watts maximum)  |  |  |  |  |
|                   | 26 VDC .52 3 26 13.52 (20 watts maximum)   |  |  |  |  |
| •                 | 28 VDC .55 6 28 6 15.40 (20 watts maximum)   |  |  |  |  |
|                   | 30 VDC <u>.60 (3)</u> 30 (3) 18.00 (3) (20 watts maximum)  |  |  |  |  |
| •                 | 33 VDC 1656 33 31 21.456   |  |  |  |  |
|                   | Inspection Remarks   |  |  |  |  |
|                   | None 12/1/64 (3).  |  |  |  |  |
|                   |  |  |  |  |  |
|                   |  |  |  |  |  |
|                   |  |  |  |  |  |
| PREPARED BY DATE  | PERFORMED BY DATE WITNESSED FOR NAM / DATE CERTIFIED FOR MARCHINE  |  |  |  |  |
| E. Adams          | Clarence Kudya & N. Navelhorest Lander 12/11/11 (3)  |  |  |  |  |
| El 4/15/64        | 12-11-64 VERIFIED BY USAF DATE   |  |  |  |  |
| FORM 608-8-39 NEW | 6-63   |  |  |  |  |

| COMPONENT NAME    | THRUST CHAMBER ASSEMBLY - 25 JH PART NO.   MAC 52-52701-265              |
|-------------------|--|
| NAME OF TEST      | FUEL AND OXIDIZER RESISTANCE TEST NO 208160 SHEET                        |
| 7.1.7.2.8         | Propellant Valve Load Analysis Test-Fuel Valve (reference paragraph 6.10 |
| _                 | Fuel valve body temp. 1603 (160 ±5) F.                                   |
|                   | GN <sub>2</sub> supply pressure 300 (300 ±10) psig                       |
|                   | Power consumption (steady state)   |
| <b>*</b> .        | Current Voltage Power  |
| ••                | 20 VDC   |
|                   | 22 VDC42 (6)   |
| •                 | 24 VDC .45 24 (2) 10.80 (3) 20 watts maximum)                            |
|                   | 26 VDC .50 26 (3) 13.00 (3) 20 watts maximum)                            |
|                   | 28 VDC55 (6) _28 (7) _15.40 (3) (20 watts maximum)                       |
|                   | 30 VDC .60 30 18.00 (3) 20 watts maximum)                                |
| •                 | 33 VDC65 33 33 21.45 3   |
| •                 | Inspection Remarks   |
| •                 | Mone 12/11/64 3.   |
|                   |  |
|                   |  |
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| PREPARED BY DAT   | TE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR MCDONNELL DATE |
| E. Adams          | Clarence Kudya F.N. Huselhopst Date Warned Les 12/14/64 3                |
| El 4/15/64        | 12-11-64 12-11-64 PA DEC 64  |
| FORM 608-B-39 NEW | 1 6-63   |

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| COMPONENT NA         |  |
|----------------------|--|
| NAME OF TEST_        | FUEL AND OXIDIZER RESISTANCE TEST NO 208160-SHEET OF 380   |
| 7.1.7.2.9            | Propellant Valve Electrical Resistance test (reference paragraph 6.3)  |
|                      | Environmental Temperature 70 (70 ±10F)   |
|                      | Resistance A - B   |
|                      | Oxidizer Valve 40.97 ohing (Acceptable per Figure 9. 78) Yes or No   |
| *                    | Fuel Valve 42.//: oh Yes or No Yes o |
| •                    | Resistance C - D (1.0 maximum) Oxidizer Valve232 ohms  |
|                      | Fuel Valve <u>.052</u> ohms  |
|                      | Inspection Remarks None 12/11/64 3   |
|                      |  |
|                      |  |
|                      |  |
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|                      |  |
| PREPARED BY E. Adams | DATE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR MCDONNELL DATE Warried Plan 12/14/64 (3)  10/4 Clause Kingu - F. H. Hasekworst Grander 12/14/64 (3)  12-11-64 12-11-64 12-11-64 12-11-64   |
| L                    | 17 17 06 07  |

FORM 608-B-39 NEW 6-63

|                  | MIDION OUTS TO SERVE                   |                     | 52-52701-265           |
|------------------|--|---------------------|------------------------|
| COMPONENT NAM    | ME THRUST CHAMBLE ASSEMBLY - 25/1      | -ART NO NAA         | 208160-61              |
| NAME OF TEST     | FUEL AND OXIDIZER RESISTANCE           | TEST NO. 20816      | 0-SHEET UF 320         |
| 7.1.7.2.10       | Propellant Valve Functional Test       | (reference parag    | raph 6.5)              |
| •                | •                                      | Oxidizer Valve      | Fuel Valve             |
|                  | Response Time                          |                     |                        |
|                  | Low Temperature $(15 \pm \frac{5}{0})$ | 16º F (3)           | 16 ° F(105)            |
| *                | Energizing Voltage (26 ±0.5)           | 24 VDC (33)         | 26 VDC                 |
| •                | Inlet Pressure (300 ±10 for "pull-in") | 300 psig(7,\$       | 300 psigan             |
|                  |  | .0039 second        | 0.00346econd           |
|                  | Inlet Pressure (zero for "drop-out")   | o psigra            | o_psig                 |
|                  |  | .0052 second        | 0.0025 seconds         |
|                  | Low Voltage Operation                  | _                   |                        |
|                  | LOW Temperature $(15 \pm 5)$           | 16º F (3)           | 16 º F 108             |
| • 1              | Inlet Pressure (300±10 for "pull-in")  | 300 psig            | 300 psig 7             |
| •                | Opening Voltage (16 maximum)           |                     | <u>5.2 VDC</u>         |
|                  | Inlet Pressure (zero for "drop-out")   | o psig              | psig                   |
| •                | Closing Voltage (1.0 minimum)          | 1.57 VDC (3)        |                        |
|                  | Inspection Remarks 220                 | ne 12/11/64         | / <b>(3)</b>           |
| •                | •                                      |                     |                        |
| PREPARED BY      | DATE PERFORMED BY DATE WITNESSED FO    | R NAA - DATE CERTIF | IED FOR MCDONNELL PATE |
| E. Adams         |  | el homes the        | mider 8/3/14/64        |
| V YI             | 12-11-64                               | 12/11/6 400         | ED BY USAF DATE        |
| TOPH 608- 8-20 1 | and the                                |                     |                        |

#### ROCKETDYNE

DEVELOPMENT LABORATORY TEST REPORT

LAB TEST NO. PREPARED BY EWR NO. FACILITY PHONE 5953% F. Pope ENV.LAB. 2061 12-11-64 PART NO. 407559 TYPE OF TEST Post Oxidizer Resistance PART SE7 25# TCA Propellant Valve S/N 9193579 Functional OXIDIZER VALVE ENVIRONMENTAL TEMPERATURE 15F CURRENT TRACE (OPENING TIME) <u>Horizontal</u> = 1 ms/cmVertica. = 10 mv/cmRequirement = 0.0065 sec/max = 0.0039 sec Actual VOLTAGE TRACE (CLOSING TIME) Horizontal = 0.5 ms/cm Vertical 10 v/cm Requirement = 0.0035 sec/maxActual 0.003k sec

Form 600-y-67 New 10-63 314

#### ROCKETDYNE

#### DEVELOPMENT LABORATORY TEST REPORT

LAB TEST NO. PREPARED BY EWR NO. FACILITY PHONE F. Pope 595396 ENV.LAB. 12-11-64 2061 PART NO. 407560 TYPE OF TEST Post Fuel Resistance PART SE7 25# TCA Propellant Valve S/N 4059525 Functional FUEL VALVE ENVIRONMENTAL TEMPERATURE 15F CURRENT TRACE (OPENING TIME) Horizontal = 1 ms/cm Vertica. 10 mv/cm Requirement = 0.0065 sec/max = 0.003k Actual VOLTAGE TRACE (CLOSING TIME) Horizontal = 0.5 ms/cm Vertical 10 v/cm Requirement = 0.0035 sec/max Actual 0.0025 sec R-15019-2

Form 600-V-67 New 10-63

| COMPONENT NA | ME_THRUST_CHAMBER_ASSEMBLY = 25# PART_NO. { MAC   52-52701-265   NAA   208160-61   PUEL AND OXIDIZER RESISTANCE: TEST_NO_208160-401_89.23   208160-5HEET   OF380 |
|--------------|--|
| 7.:1.7.211   | Propellant Valve Dielectric Strength Test (reference paragraph 6.4)  |
|              | Oxidizer Valve Fuel Valve  Voltage Current Voltage Current  Volts Microamps Volts Microamps  500 ±10 500 max. 500 ±10 500 max                                    |
| , –          | A to Ground 500 6 58 63 500 6 76 63  |
| -  -         | A to C 500 (3) 36 (3) 500 (3) 16 (3)   |
| <del> </del> | Inspection Remarks Tone 12/11/64 CD  |
| •            |  |
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| •            |  |

DATE WITNESSED FOR NAA DAT

FORM 608-B-39 NEW 6-63

PERFORMED BY

PREPARED BY

E. Adams

|                 | •  |  | 65           |
|-----------------|--|--|--------------|
| COMPONENT NAM   | ME THRUST CHAMBER ASSEMBLY - 25#                               | PART NO { MAC  |              |
| NAME OF TEST_   | FUEL AND OXIDIZER RESISTANCE                                   | TEST NO 208160 401 89.2                                  |              |
| 7.1.7.2.12      | Propellant Valve Proof Pressure a paragraph 6.1)               |  | ,            |
|                 | Proof Pressure High Temperature (157 - 15) Pressure (500 + 10) | Oxidizer Valve Fuel Valve  162 F F 169  500 psign 500 ps | r 🚱          |
| *               | Time Duration (3 minimum)                                      | 3 minut 3 min  | utes (?)     |
| •               | Leakage<br>Voltage (26 <sup>±</sup> Q.5)                       | 26 VDC (3) 26 VDC  | (F)          |
|                 | Inlet Pressure (500 ±10)                                       | 500 psig 500 ps  | 18 (27)      |
|                 | 'Time Duration<br>(5 minimum)                                  | 5 minut 5 min  | ute (33)     |
|                 | Loakage Rate (2.23 maximum)                                    | •  | C He         |
|                 | Inspection Remarks   | 12/1/64  |              |
| • •             |  |  | ;            |
| •               | •  |  |              |
|                 | ••   |  |              |
|                 |  |  | :            |
|                 |  |  |              |
|                 |  |  |              |
|                 | DATE PERFORMED BY DATE WITNESSED FOR  0/64  Claunce Kudzie  13 | VERIFIED BY USAF   | DATE<br>DATE |
| FORM 608-8-39 1 | JFW 6-63   | 1/1/20   | 61           |

| COMPONENT NAME TI | HRUST CHAMBER ASSEMBLY - 25# PART NO. \ MAC 52-52701-265   |
|-------------------|--|
| NAME OF TEST_DISA | SSEMBLY AND INSTECTION TEST NO. 208160-401 89.3 OF 320   |
| Reference:        | MAC SCD 52-52701, Revision F, paragraph 6.2.3.20   |
| 7.1.8             | Disassembly and Inspection of Propellant Valves  |
| 7.1.8.1           | Test Procedure   |
| 7.1.8.1.1         | Machine, on the oxidizer propellant valve, the seat assembly to spacer weld to loosen the seat. Only the minimum amount of material to accomplish this shall be removed. The seat assembly P/N 407664 shall not be removed at this time. |
| 7.1.8.1.2         | Wachine the filter assembly to solenoid weld to loosen the filter. Only the minimum amount of material to accomplish this shall be removed. The filter assembly P/N NA5-28097-17 shall not be removed at this time.                      |
| 7.1.8.1.3         | Remove, bag and identify the seat assembly.  |
| 7.1.8.1.4         | Remove, bag and identify the armature P/N 407569.  |
| 7.1.8.1.5         | Remove, bag and identify the spring P/N 406806.  |
| 7.1.8.1.6         | Remove, bag and identify the filter assembly.  |
| 7.1.8.1.7         | Bag and identify the solenoid assembly.  |
| 7.1.8.1.8         | Repeat 7.1.8.1 through 7.1.8.1.7 for the fuel propellant valve.  |
|                   | NOTE: Only authorized personnel shall have access to stored DAT hardware.  |
|                   |  |

PREPARED BY: DATE

R.COLO

CHECKED BY: DATE

LA Serge 12/12/14 FORM 608-8-38 NEW 6-63

Rev. r f. h. Manightate 12/28/54

#### ROCKETDYNE A DIVISION OF NORTH AMERICAN AVIATION, INC.

## DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

|                     | THRUST CHAMBER ASSEMBLY - 25# PART   | 111 A A 202160 64               |
|---------------------|--|---------------------------------|
| NAME OF TEST DISAS  | SSEMBLY AND INSPECTION TEST  | NO 208160-SHEET OF 320          |
| 7.1.8.2             | Post Test Inspection   |                                 |
| 7.1.8.2.1           | Component Identification   |                                 |
|                     | Oxidizer Valve Fue:  | L Valve                         |
| •                   | P/N <u>407559 40</u>   | 17560                           |
| •                   | s/n <u>9193579</u> <u>40</u>   | 259525                          |
| 7.1.8.2.2           | Disassembly of Propellant Valves (Ref. 7.1.8.1.1 through 7.1.8.1.8)          | ference: Paragraphs             |
|                     | The propellant valves were disassemble called for were bagged and identified | led and all parts               |
|                     | Inspection Remarks: NO VISIBLE   | DAMAGE OTHER                    |
|                     | THAN THAT CAUSED BY DIS  | SSEMBLY                         |
|                     |  |                                 |
|                     |  |                                 |
|                     |  |                                 |
|                     |  |                                 |
| PREPARED BY DATE    | PERFORMED BY DATE WITHESSED FOR HAA DA                                       | TE CENTIFIED FOR MCDONNELL DATE |
| R.Cole PC           |  | VERIFIED BY USAF DATE           |
| FORM 608-B-39 NEW 6 | -63  | - 1/10/65                       |
| Rev. D 1. D Mari    | Censes Date 12/28/04   | -                               |

| COMPONENT NAME | THRUST CHAMBER ASSEM | BLY - 25# PART      | NO. { MAC 52-52701-265         |
|----------------|----------------------|---------------------|--------------------------------|
| NAME OF TEST   | ENVIRONMENT AND SERV | ICE LIFE TESTS TEST | NO. 208160-401 SHEET 90 OF 380 |

Reference:

MAC SCD 52-52701, Revision F, Figure 12

7.2

Thrust Chamber Assembly Number 2

This subsection specifies the tests which are to be performed on Thrust Chamber Assembly No. 2.

| 1 |              |         |                   |         |                         |      |
|---|--------------|---------|-------------------|---------|-------------------------|------|
| l | PREPARED SY: | DATE    | APPROVED FOR NAA: | DATE    | APPROVED FOR MCDONNELL: | DATE |
| 1 | L. Adams VT  | 4/10/11 |                   |         |                         |      |
| 1 | 01150115     | 1/10/04 | I IMC.            |         |                         |      |
| ı | CHECKED BY:  | DATE    | La Contraction    | 4-13-64 |                         | _    |
| 1 | 2/ 1/7/1000  | 49.00   | y ary various     | 1 13 47 |                         |      |
| 1 |              |         | <del></del>       |         | <del></del>             |      |

FORM 608-B-38 NEW 6-63

| COMPONENT MAA         | THRUST CHAMBER ASSEMBLY - 25#   | MAC 52-52701-265  |  |  |  |  |
|-----------------------|---|---|--|--|--|--|
| COMPONENT NAM         | PART NO. 1 NAM 203160-61  |   |  |  |  |  |
| NAME OF TEST_         | PRE-TEST INSPECTION   | TEST NO. 208160-SHEET_910F 380                                |  |  |  |  |
| Reference:            | MAC SCD 52-52701, Revision F, parag   | grapii 6.2.2.1  |  |  |  |  |
| 7.2.1                 | Pre-Test Inspection - TCA #2  |   |  |  |  |  |
| 7.2.1.1               | Test Procedure  |   |  |  |  |  |
| 7.2.1.1.1             | Verify that the TCA is of the property passed the Acceptance Test of Rocker RA0220-354. Only the TCA's that corequirement shall be accepted for I | etdyne specification omply with the above                     |  |  |  |  |
| 7.2.1.1.2             | Record the Rocketdyne Part Number   | and Serial Number of the TCA.                                 |  |  |  |  |
| 7.2.1.1.3             | Record the Rocketdyne Part Number a oxidizer propellant valve.  | and Serial Number of the                                      |  |  |  |  |
| 7.2.1.1.4             | Record the Rocketdyne Part Number a fuel propellant valve.  | and Serial Number of the                                      |  |  |  |  |
| 7.2.1.1.5             | Record the McDonnell Part Number of   | f the TCA.  |  |  |  |  |
| 7.2.1.1.6             | Inspect the TCA for visual evidence Comment on all visual defects.  | e of damage or deterioration.                                 |  |  |  |  |
| 7.2.1.1.7             | Braze propellant valve inlet adapted in the stubs as defined in Rock RAO607-009.  | ers to the fuel and oxidizer<br>ketdyne Process Specification |  |  |  |  |
| 7.2.1.1.8             | Perform Weight Determination of par   | ragraph 6.6.  |  |  |  |  |
|                       |   |   |  |  |  |  |
|                       |   |   |  |  |  |  |
|                       |   |   |  |  |  |  |
|                       |   |   |  |  |  |  |
| PREPARED BY: E. Adams | DATE APPROVED FOR NAA: DATE A 4/10/64   | TE APPROVED FOR MCDONNELL: DATE                               |  |  |  |  |
| CHECKED BY:           | DATE SOLD U-13-1  | .11   |  |  |  |  |

FORM 608-B-38 NEW 6-63

|                        | AF THRUDT CHAEBE   | H ASSEMBLY -   | - 25# - 040  | T NO. \ MAC   | 52701-265   |
|------------------------|--|--|--|---|---|
| COMPONENT NAM          | FRE-TEST INSP  | •  |  | LNAA  | 8160-61<br>01<br>HEET <u>9</u> 20F <u>38</u> 0  |
| 7.2.1.2                | Test Data - TCA  | ,  |  | SI NO ECOTOD S  | ncc 1   |
|                        |  |  |  |   |   |
| 7.2.1.2.1              | Component Identi   |  | Oxidizer   | Fuel  |   |
|                        | Component liame  | TCA  | Valve  | Valve   |   |
|                        | McDonnell Part N   | o. 52.527  | 01-265   |   |   |
|                        | Rocketdyne Part  | No. <u>202160-1</u>                                  | 1 407559   | 407560  | •   |
| •                      | Component Serial   | No.405 223   | 2 4054460  | 4055/62   | .*  |
| 7.2.1.2.2              | Inspection (Refe   | rence parag  | raph 7.2.1.1   | )   |   |
| 7.2.1.2.2.1            | The TCA was inspand had passed to (Yes) or No).  |  |  |   |   |
| 7.2.1.2.2.2            | Propellant valve<br>valves per parag   | e inlet adap<br>graph 7.2.1.                         | ters were in 1.7 YES   | stalled on the (Yes) or No).  | propellant  |
| 7.2.1.2.2.3            | Inspection Remark  | ·ks  | •  | · · · ·   |   |
|                        | سو م ود. پوره پنجوسه ، يجو به ليمه خودموند له دره ه  | Non  | 1E   |   | •   |
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| PREPARED, BY  E. Adams | DATE PERFORMED BY  | DATE WITNES  | SED FOR NAA.   | DATE CERTIFIED F  | OR MCDONNELL CATE  Programs  12/16/62  Y, USAF  CHECKER  CATE  OR MCDONNELL CATE  12/16/62  PAGE  OR MCDONNELL CATE  12/16/62  PAGE  OR MCDONNELL CATE  12/16/62  PAGE  OR MCDONNELL CATE  12/16/62  PAGE  OR MCDONNELL CATE  12/16/62  PAGE  OR MCDONNELL CATE  PAGE  PAGE  OR MCDONNELL CATE  PAGE  PAGE  OR MCDONNELL CATE  PAGE |
| FORM 608-B-39          | 1'<br>NEW 6-63   |  |  | · · · · · · · · · · · · · · · · · · ·   | <del>- 1-00 3/13/64</del>   |

|                   | TERUST CHANGER ASSENDEY = 25# BART   | (MAC 52-5.101-265                       |
|-------------------|--|---|
| COMPONENT NAME    | PART PART  | NO. NAA 2081c0-61                       |
| NAME OF TEST      | PRE-TEST INDEPENTION TOO   | -401                                    |
| NAME OF TEST      | IES .  | T NO 208160 SHEET 93 OF £0              |
|                   |  |   |
| 7.2.2.2.3         | Weight Determination Test Data (refer  | rnce paragraph 6.6)                     |
| •                 |  |   |
|                   | All property of closures were removed f  | rom the TCA.                            |
| •                 | Yes (Yes or No)  | ¥ e e e e e e e e e e e e e e e e e e e |
| •                 | The TCA dry weight was 3.15 pour   |   |
|                   | (Record to the nearest one-hundredth p   | oound)                                  |
|                   | ( and a second of the second o | ,                                       |
| ·                 | Inspection Remarks   |   |
| · <b>,</b>        | HOHE   |   |
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| PREPARED BY DAT   | E PERFORMED BY DATE WITNESSED FOR NAA  | DATE CERTIFIED FOR MCDONNELL DATE       |
| E. Acars 7/36     | 77. Votc 10  | y. V. Marriagens 14/16/6                |
|                   |  | VERIFIED BOYSAF                         |
|                   | 8. 20 in me Murching   | 0-70-64                                 |
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| COMPONENT NAM   | ME  |
|---|---|
|   | TEMPED ATITUTE CHOOK  |
| NAME OF TEST_   | TEST NO. 208160-SHEET 94 OF 380   |
| Reference:  | MAC SCD 52-52701, Revision F, paragraph 6.2.3.7   |
| 7.2.2   | Temperature Shock - TCA #2  |
| 7.2.2.1   | Test Procedure  |
| 7.2.2.1.1   | Place the TCA unit in a temperature chamber maintained at a temperature of 185 ±5F.   |
| 7.2.2.1.2   | Expose the TCA to 185 $\pm$ 5F for a continuous period of four hours minimum.   |
| 7.2.2.1.3   | Transfer the TCA unit to a temperature chamber maintained at a temperature of -40 +5F.  NOTE: Throughout the temperature shock testing the transfer of the TCA from one temperature chamber to another shall be accomplished within a maximum time limit of five minutes. |
| 7.2.2.1.4   | Expose the TCA unit to -40 ±5F for a continuous period of four hours minimum.   |
| 7.2.2.1.5   | Repeat paragraphs 7.2.2.1.1 through 7.2.2.1.4 two more times.   |
| 7.2.2.1.6   | Allow the TCA unit to return to room ambient temperature.   |
| 7.2.2.1.7   | Within one hour,, following stabilization of the TCA's temperature, begin the first of the following procedures. The tests shall be carried through to completion without delay. In the event of a structural failure see paragraph 3.6.                                  |
| 7.2.2.1.7.1   | Perform Propellant Valve Proof Pressure and Leakage Test per paragraph 6.1.   |
|   | Perform Thrust Chamber Proof Pressure and Leakage Test per paragraph 6.2.   |
| PREPARED ET: E. Adams A CHECKED BY:  7/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/ | DATE APPROVED FOR NAA:  OATE APPROVED FOR MCDONNELL:  DATE  110/64  DATE  115-64  NEW 6-63  |

#### ROCKETHYNE

| COMPONENT NAM   | TEN                        | RUST CHAMBEI<br>PERATURE SI |       | MBLY - 25#         | _ PART NO<br>_ TEST NO | $\left\{\begin{array}{c} MAC - 2 \\ NAA - 2 \end{array}\right.$ | 2-52701 <i>-</i> 26<br>08160-61<br>01<br>HEET_950F |      |
|---|----------------------------|-----------------------------|-------|--------------------|------------------------|---|--|------|
| 7.2.2.1.7.3   | Perform 6.3.               | Propellant                  | Valve | Electrical         |                        |   |  |      |
| 7.2.2.1.7.4   |                            | Propellant                  | Valve | Dielectri <b>c</b> | Strength               | Test per  | paragraph  |      |
| 7.2.2.1.7.5   | Perform                    | Propellant                  | Valve | Functional         | Test per               | paragraph   | 6.5.   |      |
|   |                            |                             |       |                    |                        | - •   |  |      |
|   |                            |                             |       |                    | ÷.                     |   |  |      |
|   |                            |                             |       |                    |                        |   |  |      |
| ·   |                            |                             |       | •                  |                        |   | •  |      |
| PREPARED BY:  E. Adams CHECKED BY:  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 9/10/60<br>DATI<br>4-10-00 | 4 St                        |       | 4-13-64            | 1                      | D FOR NEDON   | NELL:  | DATE |

| COMPONENT NAM  | ME THRUST CHAMBER ASSEMBLY  | - 25# PART NO MAC 52-52701-265  |
|----------------|---|---|
| NAME OF TEST   | TEMPERATURE SHOCK   | TEST NO. 208160- SHEET 96 OF 380  |
| 7.2.2.2        | Test Data - TCA #2  |   |
| 7.2.2.2.1      | Component Identification  |   |
| •              | Component Name TCA  |   |
|                | McDonnell Part No. 52-52  | <u> 7</u> 01 - 265  |
|                | Rocketdyne Part No. 2081  | 6C-61   |
| •              | Component Serial No. 4058   | <u>2</u> 32   |
| 7.2.2.2.2      | Temperature Shock Test (refe  | erence paragraph 7.2.2.1)   |
| 7.2.2.2.1      | to a temperature of 185 4 (4 minimum) hours.  | cerature chamber where it was exposed (185 ±5F) for a time period of 8-20-64  |
| 7.2.2.2.2.2    | The TCA was transferred to a exposed to a temperature of period of U(3) (4 minimum than five minutes. 1 = 1 |   |
| 7.2.2.2.3      | exposed to a temperature of   |   |
| 7.2.2.2.2.4    | The TCA was transfered to a exposed to a temperature of period of 4 (25) (4 minimum than five minutes 1/55  | temperature chamber where it was  temperature chamber where it was  10° F (-40 +5F) for a time  10° Transfer time was less  (Yes or No) |
| 20504050       |   |   |
| E. Adams       | DATE PERFORMED BY DATE WITNESS  14 71 . 12 8 21 - 64 82   | SED FOR NAA DATE CERTIFIED FOR McDONNELL CATE  VERIFIED BY USAF DATE  121-64  |
| ORM 608-B-39 N |   | POLIOCOLUNIOS TATAL   |

|                      | ME THRUST CHAMBER ASSEMBLY - 25# PART NO. MAC 52-52701-265   |
|----------------------|--|
| COMPONENT NAM        | CNAA   |
| NAME OF TEST         | TEMPERATURE SHOCK TEST NO 208160- SHEET 97 OF 380  |
| 7.2.2.2.5            | The TCA was transfered to a temperature chamber where it was exposed to a temperature of 185 F (185 +5F) for a time period of 4 (4 minimum) hours. Transfer time was less than five minutes. YESO (Yes or No) 500 C 1027  START C 10:28  |
|                      | The TCA was transferred to a temper three chambere where it was exposed to a temperature of -40 F (-40 +5F) for a time period of 4 minimum) hours. Transfer time was less than five minutes. YF5, (Yes or No)  |
| 7.2.2.2.2.7          | Inspection Remarks   |
| <u>.</u><br>         | NCME   |
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| PREPARED BY E. Adams | DATE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR McDONNELL DATE CERTIFIED FOR MCDONNELL DATE CERTIFIED FOR CERTIFIED FOR CERTIFIED FOR CERTIFIED FOR CERTIFIED FOR CERTIFIED FOR CERTIFIED FOR CERTIFIED FOR CERTIFIED FOR CERTIFIED FOR CERTIFIED FOR CERTIFIED FOR CERTI |
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|---------------|--|--|
| COMPONENT NAM | ME THRUST CHAMBER ASSE                                     | MBLY - 25# PART NO. \( \begin{array}{ll} MAC & 52-52701-265 \\ NAA & 203160-61 \end{array} |
| NAME OF TEST  | TEMPERATURE SHOCK  | TEST NO 203160-401 SHEET 98 OF 380   |
| 7.2.2.2.3     | Propellant Valve Proof paragraph 6.1)                      | Pressure and Leakage test (reference   |
|               | Proof Pressure   | Oxidizer Valve Fuel Valve  |
|               | Pressure<br>(500 ±10)                                      | 500 psig 500 psig  |
|               | Time Duration (3 minimum)                                  | minutes 3 minutes  |
|               | Leakage<br>Voltage (26 <sup>±</sup> 0.5)<br>Inlet Pressure | 26 VDC (7 26 VDC (8) 500 psig  |
|               | (500 ±0)  Time Duration (5 minimum)                        | 165 minutes 5 minutes  |
| •             | Leakage Rate (2.23 maximum)                                | Zero scc He 6 min  |
| •             | Inspection Remarks   | NONE   |
|               |  |  |
|               |  |  |
|               |  |  |
|               |  |  |
| PREPARED BY   | , l  | WITNESSED FOR NAA DATE CERTIFIED FOR MCDONNELL DATE  |
| E. Adams 5/22 | 164 7.3 Vaja   | VERIFIED BY USAF DATE STILLY   |
| FORM 608-B-39 |  |  |

| NAME OF TEST            | METHRUST_CHAMBER_ASSEMBI<br>TEMPERATURE_SHOCK | N. I.                    | AC 52-52701-265<br>AA 208160-61<br>08160-SHEET 99 OF 380 |
|-------------------------|---|--------------------------|--|
| 7.2.2.2.4               | Thrust Chamber Proof Press<br>paragraph 6.2)  | sure and Leakage test    | (reference   |
|                         | Proof Pressure                                |                          |  |
|                         | Pressure<br>(392 <u>+</u> 10)                 | 1st Applifytion 342 psig | 2nd Appl tion 392 berg                                   |
|                         | Time Duration (3 ±0.25)                       |                          |  |
|                         | Voltage (12 <sup>±</sup> 2.0)                 | 12 mc                    | 120  |
| •                       | Inspection Remarks                            | No EVIDENC               | e 0F   |
| • •                     | Leakage 3                                     |                          |  |
| •                       |   |                          |  |
|                         |   |                          |  |
|                         |   |                          |  |
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|                         |   |                          |  |
|                         |   |                          |  |
|                         |   |                          |  |
| PREPARED BY<br>E. Adams |   | SSED FOR NAA DATE CER    | TIFIED FOR MCDONNELL DAT                                 |
| -9+ 4/                  | 10/14 7 7 Doge 75                             | Miurdisien O E           | FIFTE BY USAF DATE                                       |

| COMPONENT N         | NAA 203160-61   |
|---------------------|---|
| NAME OF TEST        | TE NO. 208160-401 100 380   |
| 7.2.2.5             | Propellant Valve Electrical Resistance test (reference paragraph 6.3)  Environmental Temperature 70 (70 ±10F) |
|                     | Resistance A - B  |
|                     | Oxidizer Valve 4.5 ohms (Acceptable per Figure 9, 3)  |
|                     | Fuel Valve  Yes or No Yes  (Acceptable per Figure 9.  |
|                     | Resistance C - D Yes or No Yes  |
|                     | Oxidizer Valve (1.0 maximum)  |
| ·                   | Fuel Valve (23 ohms   |
|                     | Inspection Remarks  |
| , ,                 | Nove 3  |
| •                   |   |
| •                   |   |
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|                     |   |
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|                     |   |
| REPARED BY E. Adams | DATE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR McDONNELL DATE                                    |
| ORM 608-B-30        | NEW 6-63  |

|               | TIBUST CHANDED ASSENTE   | v 35#(M                | AC_52-52701-265              |
|---------------|--|------------------------|------------------------------|
| COMPONENT N   | AME THRUST CHAMBER ASSEMBL   | LN                     | ΔΔ 208160-61                 |
| NAME OF TEST  | TEMPERATURE SHOCK  | TEST_NO                | 08160_401<br>SHEET_1010F_380 |
| 7.2.2.2.6     | Propellant Valve Dielectr paragraph 6.4)   | ic Strength Test (refe | erence                       |
| T             | The second secon | Oxidizer Valve         | Fuel Valve                   |
|               |  | Voltage Current        | Voltage Current              |
| ·             | •.   | Volts Microamps        | Volts Microamps              |
|               |  | 500 ±10 500 max.       | 500 ±10 500 max              |
|               | A to Ground  | 9500 ba                | 500 646                      |
|               | C to Ground  | 🕏 50 0 50 E            | 500 \$ 49 3                  |
|               | A to C   | 9500 15 ®              | 5003 18 3                    |
| •             | Inspection Remarks   | <del></del>            |                              |
|               | None   | <b>3</b>               | ز                            |
|               |  |                        |                              |
|               |  |                        |                              |
| · .           |  |                        |                              |
|               |  |                        |                              |
|               |  |                        |                              |
|               |  |                        |                              |
|               | •  | •                      | <b>Y</b>                     |
|               | •  |                        | •                            |
|               |  | •                      |                              |
|               |  | • •                    |                              |
|               |  |                        | •                            |
| PREPARED BY   | DATE PERFORMED BY DATE WITH  | ESSED FOR NAA DATE CER | TIFIED FOR MCDONNELL DATE    |
| -CH           | 1/10/11 8-21-64  |                        |                              |
| E. Adams      | 1 - 8 00 124   | S. VEF                 | RIFIED BY USAF DATE          |
| •             | Justy. H   | Musikion 6 1           | Mireun Stayling              |
| FORM 608-B-39 | NEW 6-63   |                        | 149                          |
|               | 9  |                        |                              |

A DIVISION OF NORTH AMERICAN AVIATION INC

## DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

|                | munical dual and Address V | 7 . 25#  | MAC 52-52701-265                                     |
|----------------|----------------------------|----------|--|
| COMPONENT NAME | THRUST CHAMBER ASSEMBLY    | PART NO. | NAA 208160-61  |
|                | *                          | TEAT NA  | MAC 52-52701-265<br>NAA 208160-61<br>208160-SHEET OF |
| NAME OF TEST   | TEMPERATURE SHOCK          | 1EST NO. |  |

Deviation Request:

Tue to lack of zener diode, ran functional test (paragraph 6.5) without a diode for closing response time for Unit #2.

Recopied from original request dated 21 August 1964.

R.A.Cole
Gemini DAT-RAT Unit

D. Manyagens for E.L.Gam
MAC Engineering

12-21-64

FORM 608-3-37 NEW 6-63

| COMPONENT NA   | ME THRUST CHAMBLE ASSEMBLY - 25  | # DART NO MAC_5                                    | 52-52701-265   |
|----------------|--|--|--|
| NAME OF TEST   | TEMPERATURE SHOCK  | NAA  | 208160-61<br>401<br>SHEET 1020F 380                              |
| 7.2.2.2.7      | Propellant Valve Functional Tes  |  |  |
|                |  | Oxidizer Valve                                     | Fuel Valve   |
|                | Response Time  |  | ·  |
|                | Ambient Temperature (70 ±10)  Energizing Voltage (26 ±0.5)   | 70 F<br>26 VDC                                     | 70 F 26 VDC  |
|                | Inlet Pressure (300 ±10 for "pull-in" Opening Time   | 300 psig   | 300 psig € \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ |
|                | (0.0065 maximum).  Inlet Pressure (zero for "drop-out")  Closing Time (0.0035maximum)  | o psig (%)   | O paig   |
|                | Low Voltage Operation  |  | 7  |
| name na        | Ambient Temperature (70 ±10) Inlet Pressure (300±10 for "pull-in") Opening Voltage (16 maximum) Inlet Pressure (zero for "drop-out") Closing Voltage (1.0 minimum) | 7.5 vdc (%)  | 70 F 300 paig VDC 0 paig L25 VDC                                 |
| ·              | Inspection Remarks TEST C<br>Diode Per Figure 4 &  | empheted with                                      | out Zener  |
|                | , J  |  | EOR Management Comment   |
| E. Adams       | J. Lally Hilling   | NAA KUO DATE CERTIFIED ON THE CERTIFIED BELLEVILLE | Wash Date  |
| ORM 608-B-39 N | EW 6-634 . //  | • •  |  |

#### DEVELOPMENT LABORATORY TEST REPORT

|            |          |              |                |                 |              |              |                |              |  |              |            |                     |   |                 |                  |                       |                |  |                  | LAB          | TEST               | NO           |                                   |               |  |    |
|------------|----------|--------------|----------------|-----------------|--------------|--------------|----------------|--------------|--|--------------|------------|---------------------|---|-----------------|------------------|-----------------------|----------------|--|------------------|--------------|--------------------|--------------|-----------------------------------|---------------|--|----|
| PREF       |          |              |                |                 |              |              |                | EWR          |  |              |            |                     |   |                 | Ī                | ILITY                 |                |  |                  |              | ONE                |              | DATE                              |               |  |    |
| PART       | J.       | .La          | IJy            | <del></del>     |              |              |                | PART         | 9539   | <del>6</del> | 200        | 3160                | <u> </u>                                    |                 | EM               | . L.                  | 1B.            | C.P.   |                  | 200          |                    |              | 8-                                | 21-           | 64   |    |
|            |          | 5#           | TCA            | Un              | it           | #2           |                | ב            | 5/N  | 405          | 200<br>821 | 32<br>32            | ا 0(  | l               |                  |                       |                |  | OST              | TE           | 1PE                | RAT          | URE                               | SH            | OCK  |    |
| Т          | Ť        | <u> </u>     | Γ              | Π               | T            | Ī            | Τ'             | T            | <del>,</del>                                     | T            | 1          | <u> </u>            | T -   | _               | FUN              | ICT.                  | LONA           | 1 A L  | Т                | т -          | Τ                  | Τ            | η-                                | Т             | 1  | Γ. |
|            |          |              |                | -               |              | ┼            | <del> </del>   | ╀            | -  |              | <u> </u>   | <u> </u>            | <u> </u>                                    | <u> </u>        |                  |                       |                |  |                  |              |                    |              |                                   |               |  |    |
|            |          |              |                |                 |              |              | $oxed{oxed}$   |              |  | _ c          | ķΠ         | CIZE                | R V   | ALX             | E                |                       |                |  |                  |              |                    |              |                                   |               |  |    |
|            |          |              |                |                 |              | P/N          | 1 40           | 755          | <b>5</b>   |              |            |                     |   |                 |                  | S                     | M              | 4054   | 160              |              |                    |              |                                   |               |  | r  |
|            |          |              |                |                 |              |              |                |              | 1  |              | †          | †                   | †-  | +-              | <del> </del>     | 5/                    | 1              | 100  | # <sub>1</sub> O | 1 -          | $\vdash$           | ╁            | -                                 |               | <del>                                     </del> | ┝  |
| +          | -+       |              |                | <u> </u>        | <del> </del> | <del> </del> | +-             | $\vdash$     | ╁  | <del> </del> | -          | ┼                   | -   | ├               | <del> </del>     | ├                     | ┼              | <del> </del>                                     | -                | -            | -                  | <del> </del> | <u> </u>                          | ├             | _  | L  |
| 1          | $\pm$    |              |                |                 | }            | -            | ├-             | ┼            | ├  | -            | <b> </b>   | _                   | ↓   | <u> </u>        | <u> </u>         | ļ                     | <u> </u>       |  | <u> </u>         |              |                    |              | <u> </u>                          |               |  | L  |
| cu.        | RRE      | NT           | TR             | ACE             |              | _            | L              |              |  |              | ٠.         |                     |   |                 |                  |                       |                |  |                  |              |                    |              | ,                                 | •             | •  | •  |
| (þ.        | PEN      | IIN          | G T            | IME             | )            |              |                |              |  |              |            |                     | •   | 4.4             |                  | And the second        |                | 7  | أنبنه            | Property     | स् हर              | -            | 3000                              | a second      |  |    |
|            |          |              |                |                 |              |              |                |              | Γ  |              |            |                     |   |                 |                  |                       | 1.             | 14 e   | ,                |              |                    |              |                                   | or, sometre   | الله .   |    |
| -          | +        |              |                |                 | <del> </del> | ╫            | }—             | ├-           | -  | -            |            |                     |   |                 |                  |                       |                | 38 A<br>29 A<br>3 A                              |                  |              |                    |              |                                   | de de vers    |  |    |
| Hb         | rik      | on           | tal            | =               | 1            | ms/          | cm             | ļ            | ļ  | $\vdash$     | ĺ          | •                   |   |                 |                  |                       |                | 4 .  |                  |              |                    |              |                                   | 5 5 m34       |  |    |
| Ve:        | rti      | ca           | 1              | =               | 50           | mv           | /cn            | 1            |  |              |            |                     |   |                 |                  |                       |                | 26 E<br>26 E                                     |                  |              |                    |              |                                   |               |  |    |
|            |          |              |                |                 | ļ            |              |                |              |  |              |            |                     | * * * *                                     |                 |                  | d - 4 á               | <b>C</b>       | e al seren<br>Geren<br>Geren                     | • • •            | . 4 16 4     | · Ng               | -1 '4        | % 2 a                             | 3.5           |  |    |
| Red        | วมร      | re           | men            | t =             | 0.           | 006          | 5 6            | ec/          | may  |              |            |                     |   |                 |                  |                       |                |  |                  | فستعصد       | سند عو             | فة محدس      | وتنفشت المكانة                    | اد مصالف<br>د |  |    |
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| Act        | tua      | 긔            |                | =               | Q.           | C04          | 0 s            | ec           | <u> </u>   | <u> </u>     | ŀ          | فقعد بدند.<br>بدر ا | معاليفين به رغ<br>پديستندر<br>د د د د د د د |                 |                  |                       | 3.50           | diamen.  |                  |              | •                  |              |                                   | • / • · •     | 4  |    |
| _          |          |              |                |                 |              |              |                |              |  |              |            |                     | e discussion                                | المارية المارية | 4.5.4.           |                       |                | ه دار<br>دوختي<br>ره مونوي                       |                  |              |                    |              | . 4                               | 1.4 5         |  |    |
| -          | İ        |              |                |                 |              |              |                |              |  | Γ            |            |                     |   |                 |                  | es es estado          |                |  |                  | - Cont       | ****               | ind the      |                                   |               | AR   |    |
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| $\bot$     | $\perp$  | $\bot$       |                |                 |              |              |                |              |  |              |            |                     |   |                 |                  |                       |                |  |                  |              |                    |              |                                   |               |  | Γ  |
|            |          |              |                |                 |              |              |                |              |  |              |            |                     |   |                 |                  |                       |                |  |                  |              |                    |              |                                   |               |  | Τ  |
| VOI        | TIA      | GE           | ΉT             | ACE             |              |              |                |              |  |              |            | <del> </del>        |   | -               | <del> </del>     | <b> </b>              | <del>  .</del> | <del>                                     </del> | <del> </del>     | <del> </del> |                    | <del> </del> | $\vdash$                          |               | -  | _  |
|            |          | _            |                |                 |              |              |                | <u> </u>     |  | <u> </u>     |            |                     | -   |                 |                  |                       |                |  |                  |              |                    |              |                                   |               |  |    |
| 701        | 4        | TIV          | * 1            | IME             | )            |              |                |              |  |              |            |                     |   |                 |                  |                       |                |  |                  |              |                    |              | 20,000                            |               |  |    |
| _          | $\perp$  | _            | _              |                 |              |              |                |              |  |              |            | # >-                |   |                 |                  |                       |                |  |                  |              |                    |              |                                   |               | **************************************           |    |
| Hor        | وعلن     | on           | al             | _               | · 0.         | <b>5</b> п   | s/c            | m.           |  |              |            | 102                 | e<br>Land                                   | Ter Si L        | M. Me Ungele     | 5.19                  |                |  |                  |              |                    |              |                                   | , a. 3        |  |    |
| Ver        |          | - 1          |                |                 |              |              |                |              |  | _            |            | S.C.                |   |                 | C. Sec C. St. Le | 4.5.                  |                | A SECTION OF                                     |                  |              | and un<br>Top<br>I | e shakki     | de de la come de<br>Se la come de | in Marie      | - Telesco  |    |
| † <u>*</u> | 7        | -            | -              | 틕               | _20          | ·Y           | /cm            |              |  | -            |            | 1                   | . E las <sup>uri</sup>                      | ÷Ϋ              |                  | * ( )                 | 4 7 E          |  |                  | 122          |                    | 1            | v i<br>Nega                       |               | 4  |    |
| +-         | +        | $\dashv$     | $\dashv$       |                 |              |              |                |              | · .  |              |            |                     | ŠŤ.   |                 | 11.54            | 8 1 9                 |                | 8 3 % 0<br>- 5 % 1                               |                  | 1211         | mais.              |              | • * •                             |               | 1  |    |
| Hec        | ui:      | ren          | nen            | t=              | 0.           | 003          | 5 s            | e <b>c</b> / | max  |              |            |                     |   |                 |                  | Acres 14              | the second     | in kulitak e.<br>Li opale si                     |                  |              | v.                 |              | 1                                 |               | 7- in 1  |    |
| Act        | ua:      | 1            | _              | =               | 0.           | 001          | 8 s            | ec           |  |              |            | × .                 |   |                 |                  |                       |                | به عو<br>ه سي<br>د د                             |                  |              |                    |              |                                   |               |  |    |
|            |          | T            | $\neg$         | $\neg \uparrow$ |              |              |                |              |  | _            |            |                     |   |                 |                  |                       |                | SHE AN   |                  |              |                    |              |                                   |               |  |    |
| T          | $\top$   | $\dashv$     | $\dashv$       | $\dashv$        |              | -            |                |              |  | _            |            |                     | į   |                 |                  |                       |                | ggar ta<br>Late of<br>Star of                    |                  |              |                    |              |                                   |               |  |    |
| ╁          | +        | +            |                |                 |              |              |                |              |  |              |            |                     |   | uta - '         | ( , <i></i>      |                       | . :            | •  |                  |              |                    |              |                                   |               |  |    |
| 4_         | 4_       | $\downarrow$ |                |                 |              |              |                |              |  |              | •          |                     |   |                 | أرحل الدحكم      | -                     |                | ن سريانون  | ننظره في تسمينا  | -            | -                  |              |                                   |               | كالتثين  |    |
|            |          |              | -              |                 | I            |              |                |              |  | I            |            |                     | ŀ   |                 |                  |                       | 1              | l  |                  |              | i                  | ı            |                                   | l             | !  |    |
|            | T        | 1            | $\neg \dagger$ |                 |              | 寸            |                |              | $\neg$   |              |            |                     |   |                 |                  |                       | ļ              |  |                  |              | -                  |              |                                   | <del> </del>  |  | _  |
| †          | +-       | +            | +              |                 |              | $\dashv$     |                |              |  | -            |            |                     |   |                 |                  |                       |                |  |                  |              |                    | <u> </u>     | <b> </b>                          | ļ             |  |    |
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|            |          | $\perp$      |                | _               |              |              |                |              | ]  |              |            |                     |   |                 |                  |                       |                |  |                  |              |                    |              |                                   |               |  | _  |
|            |          | Γ            | T              |                 |              |              |                |              |  |              |            |                     |   |                 |                  |                       |                | <b></b>  |                  |              |                    | <del></del>  | <b> </b>                          | <del> </del>  |  |    |
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Form 600-4-67 New 10-63 334

#### ROCKETDYNE

DEVELOPM

| ENT LABORATORY TEST REPORT |              |
|----------------------------|--------------|
|                            | PAGEOF       |
|                            | LAB TEST NO. |

| PREPARED BY                                       | EWR NO.             | FACILITY   | PHONE   | DATE   |
|---|---------------------|--|---|--|
| J. Lally  | 595396              | ENV.LAB CP   | 2061  | 8-21-64  |
| PART  | PART NO. 208160-61  | TYPE OF TEST PO  | st Tempera  | ture Shock   |
| SE7 25# TCA Unit #2                               | S/N 4058232         | Functional   |   |  |
|   |                     |  |   |  |
|   | Talla               | VALVE  |   |  |
| <del>                                      </del> |                     |  |   |  |
| +   | /N 407560           | S/N40551   | 62  |  |
|   |                     |  |   |  |
| CURRENT TRACE                                     |                     |  |   |  |
| (OPENING TIME)                                    |                     |  |   |  |
| (A) DIVING LINE I                                 |                     |  |   |  |
|   |                     |  | e 7.<br>3 s.:<br>3 s.   |  |
| Horizontal = 1 ms/cr                              |                     |  | © বীনু<br>জন্ম<br>হ   |  |
|   |                     |  | 6 75<br>6 75<br>8 25  |  |
| Vertical = 50mv/cr                                | n                   | 1  | ം പുറ്റെടുന്നു.<br>ഇത്രോഗ്യം വിവര്യം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം<br>പുരുത്തിലെ വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവരം വിവ  |  |
|   |                     |  | . Δα.<br>(* Δα. *   |  |
| Requirement = 0.0065                              | sec/nax             | The second second second   | and the second  |  |
| Actual = 0.0038                                   |                     |  |   |  |
| 300000000000000000000000000000000000000           | sec                 |  | ٠.  |  |
| <del></del>                                       |                     | d landers process to act from the  | <u> </u>  |  |
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| OLTAGE TRACE                                      |                     | <del>-  -   </del>   | <del></del>   |  |
| ╼╅╌╌╂╼═╁╌╌╁╼═╅╌┈┼══╁╌                             | <del>- - - - </del> | •  |   |  |
| (CLOSING TIME)                                    |                     |  |   |  |
|   |                     |  |   |  |
| iorizontal = 0.5 ms/                              |                     |  |   | 11   |
|   | 'CID                |  |   |  |
| Vertical = 20 v/cm                                |                     | A MARKET I SE  |   |  |
|   |                     |  |   | 141.042  |
| Requirement = 0.0035                              | sec/max             | Lambia - and english a say in 2.5  | t   | I No Series at a religion  |
|   |                     |  |   |  |
| ctual  = 0.0017                                   | Z sec               | The control force of the control for the control of | and a control of the |  |
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|   |                     |  |   |  |
|   |                     |  |   |  |
|   |                     |  |   |  |
|   |                     |  |   |  |

|                   |   | •  |   |
|-------------------|---|--|---|
| COMPONENT NAME    | THRUST CHAMBER ASSETS Y - 25#   | PART NO J                                | -52701-265<br>8160-61                   |
| NAME OF TEST      | IMPULSE SIGNAL WIPPH  | 208160-1101                              | HEET 1.030F380                          |
| Reference:        | MAC SCD 52-52701, Revision F, Para                                      | graph 6.3.1.3.2.2                        |   |
| 7.2.3             | Impulse Signal Width - TCA #2   |  | DEC 2 2 6 (18)                          |
| 7.2.3.1           | Test Procedure  |  | NEC 2 2'64 (FG)                         |
| 7.2.3.1.1         | Nominal Pulse Width   |  | AS 5 S. PA (161)                        |
| 1.2.3.1.1.1       | Install the TCA in the pulsing tes all connections are properly secur   | t fixture and insu                       | re that 181                             |
|                   | Visually inspect the propellant fe                                      |  | ~ \ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ |
| 7.2.3.1.1.3       | djust the propeklant tank pressur design nominal inlet pressures spe    | izing system to ob<br>cified in Paragrap | tain TCA                                |
| 7.2.3.1.1.        | Activate the altitude chamber to a simulated pressure altitude of 100   | ttain and maintain,000 feet or great     | a<br>er. 6602234                        |
| 7.2.3.1.1.5       | stablish a valve energizing volta                                       | ge of 26 ± 1 VDC.                        | AT 5 5,84                               |
| 7.2.3.1.1.6       | Adjust the TCA electrical control 2.5 second continuous pulse.          | system to fire one                       | (1) occ ;                               |
| <b>A</b> S        | NOTE: Use procedures outlined in Paragraph 2.3.                         | the operations man                       | ual of                                  |
| 7.2.3.1.1.7       | Start Recording instrumentation.  |  | <b>65</b> 2 2 70                        |
| 7.2.3.1.1.8       | nergize both TCA propollent valve<br>the TCA for the pulse duration set | s simultaneously t<br>in Paragraph 7.2.  | o fire<br>3.1.1.6@2224 (                |
| 7.2.3.1.1.9       | De-energize both propellant valves                                      | simultaneously.                          | WL 2 2 54                               |
| CHECKED BY:       | DATE APPROVED FOR NAA: DATE  11-20-44  DATE  11-20-44                   | APPROVED FOR McDONN                      | ELL: BATE                               |
| FORM 608-B-38 NEV |   |  |   |

| COMPONENT NAME.                                  | THRUST CHAMBLE ACCEPBLY - 25# PART NO. { MAC 52-52701-265   |
|--|---|
| NAME OF TEST                                     | Impulse signal weath         Test no. 208160-61           Test no. 208160-61         380                            |
| 7221110  |   |
|  | Adjust the TCA electrical control system to fire 20 pulses of   |
|  | II milliseconds duration at 3 second periods.   |
|  | Lirt recording instrumentation. 962294  |
| 7.2.3.1.1.13                                     | Fire pulse sequence.  |
| 7.2.3.1.1.1                                      | Stop recording instrumentation.   |
| 7.2.3.1.1.15                                     | Repeat steps 7.2.3.1.112 through 7.2.3.1.1.14 for 20 pulses.  |
| 7221116  | of 15 milliseconds duration at 3 second periods.  |
| 1.62.0 J. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. | Repeat steps 7.2.3.1.1.12 through 7.2.3.1.1.14 for 20 pulses Of 20 millisecond duration at 3 second periods.        |
| 7.2.3.1.1.17                                     | Repeat steps 7.2.3.1.1.12 through 7.2.3.1.1.14 for 20 pulses of 30 milliseconds duration at 3 second periods.       |
| 7.2.3.1.1.18                                     | Repeat steps 7.2.3.1.1.12 through 7.2.3.1.1.14 for 20 pulses  |
|  | of 50 millisecond duration at 3 second periods. 2264  |
| 7.2.3.1.1.19                                     | Repeat steps 7.2.3.1.1.12 through 7.2.3.1.1.14 for 20 pulses at 100 millisecond duration at 3 second periods. 32284 |
| 7.2.3.1.1.20                                     | Discontinue testing and remove TCA from test stand per paragraph 6.7.   |
| 7.2.3.1.1.21                                     | Perform decontamination per paragraph 6.8. 30235:   |
| 7.2.3.1.1.22                                     | Reduce data per SEM 4388-4040 to determine pulse width required for MIP of 0.25 lb. SEC total impulse.              |
|  |   |
| PREPARED BY:                                     | DATE APPROYED FOR NAA: DATE APPROYED FOR MCDONNELL: DATE  |
| R. Cole  | 11-30-14 HO.  |
| CHECKED BY:                                      | DATE  |
| Jell Donneght                                    | 11.20.14 18 10 11-13-64   |
| FORM 608-B-28 NEV                                | 16-62   |

R-15019-2

| COMPONENT NAME            | THRUST   | CHAMDER ASSEMBLY                 | Z - 25# p                   | ART NO MAC 52-52701-265                            |
|---------------------------|--|----------------------------------|-----------------------------|--|
| NAME OF TEST              | IMPULS   | E SIGNAL WIDTH                   | т                           | 208160-61<br>201<br>EST NO. 208160-SHEET 1050F380  |
|                           |  |                                  |                             |  |
| 7.2.3.1.2.                | Pulse Rep  | eatability Test                  | (Room Temp                  | perature)  |
| 7.2.3.1.2.1               | Prepare f<br>through 7   | acility for test                 | ing per para                | agraph 7.2.3.1.1.1                                 |
| 7.2.3.1.2.2               | Conduct 27.2.3.1.1   | 0 pulses of the .22 with a minim | pulse width<br>um pulse per | calculated in paragraph riod of three (3) seconds. |
| 7.2.3.1.2.3               | Establish  | a valve energiz                  | ing voltage                 | of 22 ±1 VDC.                                      |
| 7.2.3.1.2.4               | Conduct 2  | 0 pulses per par                 | agraph 7.2.                 | 3.1.2.2.   |
| 7.2.3.1.2.5               | Establish  | a valve energiz                  | ing voltage                 | of 30 ±1 VDC.                                      |
| 7.2.3.1.2.6               | Conduct 2  | 20 pulses per par                | agraph 7.2.                 | 3.1.2.2.   |
| 7.2.3.1.2.7               | Discontin  | nue testing.                     | •                           |  |
| 7.2.3.1.2.8               | Review all recorded  |                                  | to verify s                 | atisfactory quality of all                         |
| 7.2.3.1.2.9               | Reduce de  | ata per SEM 4388-                | 4040.                       |  |
| 7.2.3.1.3                 | Pulse Re   | peatability Test                 | (High Tem                   | perature)  |
| 7.2.3.1.3.1               | Install Iron-Constantan thermocouples on the TCA inlets and the TCA injector manifold. |                                  |                             |  |
| 7.2.3.1.3.2               | Install provisions for heating the propellants and the TCA injector to 160 $\pm$ 5 F.  |                                  |                             |  |
| 7.2.3.1.3.3               |  | facility for test                | ing per par                 | agraph 7.2.3.1.1.1.                                |
| PREPARED BY: J. A. Ganger | DATE   | APPROVED FOR HAA:                | DATE                        | APPROVED FOR MCDONNELL:                            |

338

CHECKED BY:

FORM 608-B-38 HEW 6-63

REVISION DA

|                 | THRUST CHAMBER ASSEMBLY - 25# PART NO \ MAC 52-52701-265  |
|-----------------|---|
| COMPONENT NAMI  | C   |
| NAME OF TEST    | IMPULSE SIGNAL WIDTH TEST NO. 208160-401 106 380  |
| _               |   |
| 7.2.3.1.3.4     | Heat the propellants and the TCA injector to 160 ±5 F.  |
| 7.2.3.1.3.5     | Conduct 20 pulses of the pulse width calculated in paragraph 7.2.3.1.1.22 with a minimum pulse period of three (3) seconds. |
| 7.2.3.1.3.6     | Establish a valve energizing voltage of 22 +1 VDC.  |
| 7.2.3.1.3.7     | Verify that the propellants and the TCA injector temperature are 160 +5 F.  |
| 7.2.3.1.3.8     | Conduct 20 pulses per paragraph 7.2.3.1.3.5.  |
| 7.2.3.1.3.9     | Establish a valve energizing voltage of 30 +1 VDC.  |
| 7.2.3.1.3.10    | Verify that the propellants and the TCA injector temperatures are 160 +5 F.   |
| 7.2.3.1.3.11    | Conduct 20 pulses per paragraph 7.2.3.1.3.5.  |
| 7.2.3.1.3.12    | Perform a verification test per paragraph 7.2.3.1.1.5 through 7.2.3.1.1.10.   |
| 7.2.3.1.3.13    | Discontinue testing.  |
| 7.2.3.1.3.14    | Review all raw test data to verify satisfactory quality of all recorded data.   |
| 7.2.3.1.3.15    | Reduce data per SEM 4388-4040.  |
| 7.2.3.1.4       | Pulse Repeatability Test (Low Temperature)  |
| 7.2.3.1.4.1     | Install Iron-Constantan thermocouples on the TCA inlets and the TCA injector manifold.                                      |
| PREPARED BY:    | DATE APPROVED FOR NAA: DATE APPROVED FOR MCDONNELL: DATE  |
| J. Ganger       |   |
| CHECKED BY:     | 1-7-65 / Wide<br>1-9-65   |
| FORM 608-B-38 I |   |

R-15019-2

#### ROCKETBYNE A DIVISION OF NORTH AMERICAN AVIATION INC

### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

|                       | CNAC 52-52701-265   |   |
|-----------------------|---|---|
| COMPONENT NAME        | THRUST CHAMBER ASSEMBLY - 25# PART NO. { MAC  |   |
| NAME OF TEST          | IMPULSE SIGNAL WIDTH TEST NO. 208160-101 107 380  |   |
| 2.3.1.4.2             | Install provisions for cooling the propellants and the TCA injector to 20 +5 F.   | ļ |
| 7.2.3.1.4.3           | Prepare facility for testing per paragraph 7.2.3.1.1.1 through 7.2.3.1.1.5.   |   |
| 7.2.3.1.4.4           | Cool the propellants and the TCA injector to 20 +5 F.   | 1 |
| 7.2.3.1.4.5           | Conduct 20 pulses of the pulse width calculated in paragraph 7.2.3.1.1.22 with a minimum pulse period of three (3) seconds.                               | 1 |
| 7.2.3.1.h.6           | Establish a valve energizing voltage of 22 +1 VDC.  |   |
| 7.2.3.1.4.7           | Verify that the propellants and the TCA injector temperatures are 20 ±5 F.  | ] |
| 7.2.3.1.4.8           | Conduct 20 pulses per paragraph 7.2.3.1.4.5.  |   |
| 7.2.3.1.4.9           | Establish a valve energizing voltage fo 30 +1 VDC.  |   |
| 7.2.3.1.4.10          | Verify that the propellants and the TCA injector temperatures are 20 ±5 F.  | 1 |
| 7.2.3.1.4.11          | Conduct 20 pulses per paragraph 7.2.3.1.4.5.  |   |
| 7.2.3.1.4.12          | Perform a verification test per paragraph 7.2.3.1.1.5.,through 7.2.3.1.1.10.  |   |
| 7.2.3.1.4.13          | Shut down facility per paragraph 7.2.3.1.1.20 and 7.2.3.1.1.21.   |   |
| 7.2.3.1.4.14          | Reduce data per SEM 4388-4040.  |   |
| •                     | NOTE: Impulse Signal Width Tests are conducted primarily for information purposes and failure to pass this test does not constitute a failure of the TCA. |   |
| PREPARED BY:          | DATE APPROVED FOR NAA: DATE APPROVED FOR MCDONNELL: DATE  | 1 |
| J. Ganger CHECKED BY: | 1-9-65 / Fecce -9-55  |   |
| (1) Denu 608-B-38 NH  | W <sup>2</sup> 6-63   | J |

#### A DIVISION OF NORTH AMERICAN AVIATION, INC.

IL 4388-5309

INTERNAL LETTER
North American Aviation, Inc.

DATE 30 December 1964

TO Address Those Concerned

FRCM Gemini DAT-RAT Unit Address D/896-388

Address SUBJECT

Deviation to Specification 208160-401, Design Approval Testing - 25 lb OAMS TCA, P/N 208160-61

This IL authorizes the use of facility verification tests prior to a hot fire test series. This verification, while not a requirement, may be conducted provided:

- 1. The test(s) duration does not exceed 3 seconds.
- 2. At least 45 minutes are allowed to pass prior to further testing.

Results of the verification test, if conducted, are to be approved by the cognizant Gemini DAT Development Engineer prior to future testing.

W. Richtenburg Gemini DAT-RAT Unit

Approved: D favrogens

J. Navrogenia

MAC Engineering

12-30-64

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7-15019-2

|                         | TO THE CHANGE AGGRETIC AT !!                                  |           | CMAC           | 52-527       | 701-265               |
|-------------------------|---|-----------|----------------|--------------|-----------------------|
| COMPONENT NAME.         | THRUST CHAMBER ASSEMBLY - 25#                                 | PART      | NO. ENAA       | 208160       | 0-61                  |
| NAME OF TEST            | IMPULSE SIGNAL WIDTH  | _ TEST    | NO 208160-     | 101<br>Sheet | 11P <sub>OF</sub> 380 |
| 723.2 T                 | est Data - TCA #2   |           | •              |              |                       |
| 7.2.3.2.1               | omponent Identification                                       | ** **.    | •              |              |                       |
| 11/24/17 C              | component Name TCA  |           |                | •            |                       |
| H                       | CDonnell Part No. 32-527                                      | 01-2      | 65             | •            |                       |
| R                       | locketdyne Part No. 208160-                                   | -61       |                |              |                       |
| C                       | Component Serial No. 40582                                    | 32        | •              |              |                       |
| A                       | accumulated Acceptance Test.Firing                            | Time,     | seconds        | 7.02         |                       |
|                         |   |           | Pro-Test       | Po           | st Test               |
|                         | Throat Diameter, inches (Average of four measurements)        | •         | 13574          | • 3.         | 578                   |
|                         | Nozzle Exit Diameter, inches                                  |           | 2,230          | . ,          | 242                   |
|                         |   |           |                | 1 2          | 272                   |
| 7.2.3.2.2(5)            | Propellant Samples  |           | Nitroger       |              | Monomethyl            |
| 1/24/64                 | •   | •         | Tetrocio       |              | Hydrazine             |
| _                       | Sample Date   | •         | 24161          | -64          | 24 NOV 64             |
|                         | Sample Batch Number   |           | 11-28:         | 2            | 11-292                |
|                         | Sample Temperature, F   |           | 60             |              | 60-F                  |
| . ‡                     | Sample Specific Gravity                                       |           | 1.470          |              | .852 62"              |
| [1                      | Met Mil Spec. Requirements (Yes or                            | r No)     | yes            |              | YXC                   |
| PREPARED BY DA E. Adams | TE PERFORMED BY DATE WITNESSED FOR IN  11/24/64    S. y Killy | 14A (1/2. | DATE CERTIFIED | Monn         | June 41/62            |

#### ROCKETDYNE

DIVISION OF NORTH AMERICAN AVIATION, INC.

IL 4388-5299

INTERNAL LETTER

North American Aviation, Inc.

DATE

21 December 1964

TO Address Inspection D/554-944

FROM

Gemini DAT-RAT Unit

Address

D/896-388

SUBJECT

Deviation to DAT Specification 208160-401

It is hereby authorized that the initial testing phase of the impulse signal width tests (paragraph 7.2.3.1 of DAT specification 208160-401) on SE7 25 lb TCA Unit #2 be repeated.

The initial data is believed to be invalid.

Gemini DAT-RAT Unit

Approved: J. D. Mav cogenia

MAC Engineering

R-15019-2

|                                       | THRUST CHAMBER ASSEMBLY - 25# PART A                   |                       | 2-52701-265        |
|---------------------------------------|--|-----------------------|--------------------|
| COMPONENT NAME                        | •  | LNAA                  | 208160-61          |
| NAME OF TEST                          | IMPULSE SIGNAL WIDTH TEST                              | va 208160-5           | HEET 1100F 380     |
| 3.3.2                                 | Test Data - TCA #2                                     | •                     |                    |
| 7.2.3.2.1                             | Component Identification                               |                       |                    |
| DEC 2 2 34                            | Component Name T.CA. 25#                               |                       |                    |
|                                       | McDonnell Part No. 52-52701-265                        | <b></b>               |                    |
| · ·                                   | Rocketdyne Part No. 208160-61                          |                       |                    |
| , <b>`</b>                            | Component Serial No. 4058232                           |                       |                    |
| •                                     | Accumulated Acceptance Test Firing Time,               | seconds               | 7.03               |
|                                       |  | Pre-Test              | Post Test          |
| •                                     | Throat Diameter, inches (Average of four measurements) | 3578                  | ,3579              |
| •                                     | Nozzle Exit Diameter, inches                           | 2.242                 | 2.260              |
| 7.2.3.2.2                             | Propellant Samples                                     |                       | <u></u>            |
| M21-4                                 |  | Nitrogen<br>Tetroxide |                    |
| (Right)                               | Sample Date  | 12-21-6               | 4 12-21-64         |
|                                       | Sample Batch Number                                    | 12~27                 | 4 12-276           |
| ••                                    | Sample Temperature, F                                  | . 60°F                |                    |
|                                       | Sample Specific Gravity                                | 1,462                 | 0.873              |
|                                       | Met Mil Spec. Requirements (Yes or No)                 | Yes                   | Yes                |
| PREPARED BY C<br>E. Adams  64. 4/10/6 | 4 E.S. Kulben 19 Kelly 32                              | /                     | TOR MODONNELL DATE |

|                                  |   |         |                       |                                | I            |
|----------------------------------|---|---------|-----------------------|--------------------------------|--------------|
| COMPONENT NAM                    | THRUST CHAMBER ASSEMBLY - 25#   | PART NO | 1 1 1 2               | 2-52701-265<br>08160-61        | -            |
| NAME OF TEST_                    | IMPULSE SIGNAL WIDTH  | TEST N  | 208160-5              | 01<br>HEET 1100 38             | 80           |
| ·7.2.3.2                         | Test Data - TCA #2  |         | •                     |                                |              |
| 7.2.3.2.1                        | Component Identification  | •       |                       |                                |              |
| A 3 DEC 2 9 54                   | Component Name 25-2-70-A  | ,       | *                     |                                |              |
| Rost                             | HcDonnell Part No. 52-52701   | 265     |                       |                                | į            |
| AFOC                             | Rocketdyne Part No. 208160-6  | /       |                       |                                |              |
|                                  | Component Serial No. 4058232  | •••     |                       |                                |              |
|                                  | Accumulated Acceptance Test Firing 1                                    | Time, s | econds 2              | 6.77                           |              |
|                                  | <b>08</b> 29 u  | Г       | re-Test               | Post Test                      |              |
|                                  | Throat Diameter, inches (Average of four measurements)                  |         | 3579                  | 3579                           |              |
|                                  | Nozzle Exit Diameter, inches  |         | 2.260                 | 2.260                          |              |
| 7.2.3.2.2                        | Propellant Samples  | •       |                       |                                |              |
| ALC 29 EV                        |   |         | Nitrogen<br>Tetroxide |                                | -            |
| Rebarac                          | Sample Date   | •       | 12/28/6               | 14 12/28/1.4                   | į.           |
| <b>©</b>                         | Sample Batch Number   |         | 12-3/1                | 12-326                         | >            |
| •                                | Sample Temperature, P   |         | . 60°                 | 77°                            |              |
|                                  | Sample Specific Gravity   |         | 1.461                 | 0.873                          | •            |
|                                  | Met Mil Spec. Requirements (Yes or                                      | No)     | YES                   | YES                            |              |
| PREPARED BY  B. Adams  Ed. 4/101 | DATE PETIFORMED BY DATE WITNESSED FOR NAME OF STREET AND MILLY 12/29/64 | 12/29/  |                       | FOR MCDONKELL  12/1/15 BY USAF | DATE<br>DAYE |
| FORM 608-8-39                    | HEN 6-63  |         |                       |                                |              |

| COMPONENT NAM                                   | TMDIITCE CTCNAT LITTMI                                 | NO { NAA 208          | -52701-265<br>3160-61   |
|---|--|-----------------------|-------------------------|
| 7.2.3.2 (A) (A) (A) (A) (A) (A) (A) (A) (A) (A) | Test Data - TCA #2                                     | · ·                   | EET 1100 380            |
| # 2 3 2 1 -                                     | Component Identification                               |                       |                         |
|   | Component Name TCA 25#                                 |                       |                         |
| 1. 1  | McDonnell Part No. 52-52701-265                        | •                     |                         |
|   | Rocketdyne Part No. 208160-61                          |                       |                         |
|   | Component Serial No. 4058232                           |                       | A 675                   |
|   | Accumulated Acceptance Test Firing Time,               | seconds 37            | _**                     |
|   |  | Pro-Test              | Post Test               |
|   | Throat Diameter, inches (Average of four measurements) | ,3579                 | ,3579                   |
|   | Nozzle Exit Diameter, inches                           | 2.260 .               | 2.260                   |
| 7.2.3.2.2                                       | Propollant Samples                                     |                       |                         |
| 655   |  | Nitrogen<br>Tetroxido | Monomethyl<br>Hydrazine |
| <b>39-</b>                                      | Sample Date  | 1-4-45                | 1-4-65                  |
|   | Sample Batch Number                                    | 1-8                   | 1-17                    |
|   | Sample Temperature, F                                  | 600                   | 775                     |
| •   | Sample Specific Cravity                                | 1.46.1                | 0.872                   |
|   | Met Mil Spec. Requirements (Yes or No)                 | YES                   | YFS.                    |
| E. Adams  6-1. 4/10/0                           | 61   | cr 1 /                | MCDONNELL DATE          |

| COMPONENT NAME          | THRUST CHAMBER ASSEMBLY - 25# PART NO  | . I IIIAV                     | 52701-265<br>160-61 |
|-------------------------|--|-------------------------------|---------------------|
| NAME OF TEST            |  | 208160-401<br>208160-SHE      |                     |
| ·7.2.3.2 ( )            | Test Data - TCA #2   | •                             |                     |
| 7.2.3.2.1 9 65          | Component Identification   |                               |                     |
|                         | Component Name TCA 25#   |                               |                     |
|                         | HcDonnell Part No. 52-52701-265.   | •                             |                     |
| JAN 9 75                | Rocketdyne Part No. 208160-61  |                               |                     |
|                         | Component Serial No. 4058232   |                               |                     |
|                         | Accumulated Acceptance Test Firing Time, s   | econds 38.1                   | 2- (86)             |
|                         | CARREL P   | ro-Test                       | Post Test           |
|                         | Throat Diameter, inches (Average of four measurements)                                   | ,3579                         | 3579                |
|                         | Nozzle Exit Diameter, inches   | 2.260                         | 2.260               |
|                         |  | 2.200                         |                     |
| 7.2.3.2.2               | Propellant Samples   | Nitrogen<br>Tetroxide         | Monomethyl          |
| Jan . 9 765             | Sample Date  | 1-4-65                        | Hydrazine           |
|                         | Sample Batch Number  | 1-8                           | 1-17                |
| •                       | Sample Temperature, F  | . 600                         | 27°                 |
|                         | Sample Specific Gravity  | 1.461                         | c.872'.             |
|                         | Met Mil Spoc. Requirements (Yes or No)   | YES                           | y'c's               |
| PREPARED BY CEL. 4/10/6 | ATE PERFORMED BY DATE WITNESSED FOR MAA DAY  4 1/9/65 DATE WITNESSED FOR MAA DAY  1/9/65 | E CERTIFIED FOR VERIFIED BY U | 1401119/15          |
| FORM 608-B-39 N         | EW 6-63  |                               | · · ·               |

R-15019-2

| COMPONENT NAME       | THRUST CHAMBER ASSEMBLY - 25# PA                         | urt no   |                       | 2-52701-265<br>08160-61 |
|----------------------|--|----------|-----------------------|-------------------------|
| NAME OF TEST         |  |          | 'LNAA ~               | 01<br>HEET 11005 380    |
| 17.2.3.2 (5.9) 15/65 | Yest Data - TCA #2                                       |          |                       |                         |
| <b>7.2.3.2.1</b>     | Component Identification                                 |          |                       |                         |
| 1/15/65              | Component Name TCA 25#                                   |          |                       |                         |
| 1, 1/20              | McDonnell Part No. 52-52701-3                            | 265      | •                     |                         |
|                      | Rocketdyne Part No. 208160-61                            |          | ,                     | •                       |
| •                    | Component Serial No. 4058232                             |          | •                     | 1/15/15                 |
|                      | Accumulated Acceptance Test Firing Ti                    | mo, se   | conds <u>#/</u>       |                         |
|                      |  | Pr       | o-Test                | Post Test               |
|                      | Throat Diameter, inches (Average of four measurements)   |          | 3579                  | .3578                   |
|                      | Nozzle Exit Diameter, inches                             | 2        | .260                  | 2.260                   |
| 7.2.3.2.2            | Propellant Samples                                       |          | 4                     |                         |
| 1/15/65              |  | •        | Nitrogen<br>Tetroxide | Monomethyl<br>Hydrazine |
|                      | Sample Date  |          | 1-13-6                | 5 1-13-65               |
|                      | Sample Batch Number                                      |          | 1-136                 | 1-138                   |
| -                    | Sample Temperature, F                                    |          | . 60°                 | 77°                     |
| •                    | Sample Specific Gravity                                  |          | 1.460                 | 0.871                   |
|                      | Met Mil Spec. Requirements (Yes or No                    | )        | YES                   | YES                     |
| B. Adams  G. 1/10/64 | PERFORMED OY DATE WITNESSED FOR NAA  E.S. Subbin 1/15/65 | DATE (S) | CERTIFIED FO          | MCDONNELL DATE          |
| FORM 608-B-39 NE     | N 6-63   |          | .l                    |                         |

ROCKETEDYNE
A DIVISION OF NORTH AMERICAN AVIATION INC

### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

|              | THRUST CHAMBER ASSEMBLY - | 25# PART NO. { MAC 52-52701-265 NAA 208160-61 |
|--------------|---------------------------|---|
|              |                           | PART NO. ( NAA 208160-61                      |
| NAME OF TEST | PULSE SIGNAL WIDTH        | TEST NO.208160- \$HEETOF                      |

IL 5388-6267

Deviation Request:

25 lb GFMINI LAT UNIT #2 (P/N 208160-61, S/N 4058232) shall be returned to SSFL to complete the DAT Test program, following the OFR (No.32656R) action. FAR action will be continued after the completion of the test program.

Recopied from original request dated 16 January, 1965.

James L. Mavragenis

MAC Engineering

2-2-65

J.A. Ganger Gemini Dat Engineering

FORM 608-B-37 NEW 6-63

R-15019-2

|                  | •  | •                     | · · · · · · · · · · · · · · · · · · · |
|------------------|--|-----------------------|---------------------------------------|
| COMPONENT NAME   | THRUST CHAMBER ASSEMBLY - 25# PART NO.                 | 20                    | -52701-265<br>3160-61                 |
| NAME OF TEST     |  | LNAA                  | TET 110.6 380                         |
|                  | Test Data - TCA #2                                     | •                     |                                       |
| 7                | Component Identification                               |                       |                                       |
|                  | Component Name TCA 25#                                 |                       |                                       |
|                  | McDonnell Part No. 52-52701-265                        |                       |                                       |
|                  | Rocketdyne Part No. 208160-61                          |                       |                                       |
|                  | Component Serial No. 4658232                           | •                     | 1/16/65                               |
|                  | Accumulated Acceptance Test Firing Time, se            | econds 43             | 1.02                                  |
|                  |  | ro-Test               | Post Test                             |
|                  | Throat Diameter, inches (Average of four measurements) | 3578                  | .3573                                 |
|                  | Nozzle Exit Diameter, inches                           | 2.260                 | 2.265                                 |
| 7.2.3.2.2        | Propellant Samples                                     |                       |                                       |
|                  | F:   | Nitrogen<br>Tetroxide | Monomethyl<br>Hydrazine               |
| 1911,2           | Sample Date  | 1-13-65               | 1-13-65                               |
|                  | Sample Batch Number                                    | 1-136                 | 1-138                                 |
| •                | Sample Temperature, F                                  | . 60°                 | 776                                   |
| •                | Sample Specific Gravity .                              | 1.460                 | 0.871                                 |
|                  | Met Mil Spec. Requirements (Yes or No)                 | YES                   | YES                                   |
| PREPARED BY C    |  | -1 /                  | OR MCDONNELL DATE                     |
| Et. 4/10/6       | 4 ES Halber 19 Kelly (5)                               | VERIFIED BY           | USAF DATE                             |
| FORM 608-B-39 IJ | W 6-63   |                       |                                       |

|                               | •  |           |                      | •                         | ,            |
|-------------------------------|--|-----------|----------------------|---------------------------|--------------|
| COMPONENT NAM                 | E THRUST CHAMBER ASSEMBLY - 25#  | PART      | I WIAL               | 52-52701-265<br>208160-61 | _            |
|                               | IMPULSE SIGNAL WIDTH   |           | LNAA                 |                           | 200          |
| NAME OF TEST                  | THI OLDS STORAG WIDIA  | _ TEST    | NO 208160-           | SHEET 1100F               | 380          |
| 7.2.3.2                       | Test Data - TCA #2   |           |                      | ,                         |              |
| 7.2.3.2.1                     | Component Identification   |           |                      |                           |              |
| 1/29/05                       | Component Name TCA   |           | •                    |                           |              |
|                               | EcDonnell Part No. 52-5270   | 1-26      | <b>.</b>             | •                         |              |
|                               | Rocketdyne Part No. 208160-  | 61        |                      |                           |              |
|                               | Component Serial No. 405823  | 2         | •                    | 1/29/65                   |              |
|                               | Accumulated Acceptance Test Firing   | Time,     | seconds 4            | 8.07                      |              |
|                               |  | / /       | Pre-Test             | Post Test                 | T            |
|                               | Throat Diameter, inches (Average of four measurements)                     | 25/5      | 35180                | 3532                      | 1/29         |
|                               | Nozzle Exit Diameter, inches   |           | 2.261                | 1                         |              |
| 7.2.3.2.2                     | Propellant Samples   | • 4       | 2.26/                | 2.458                     | 1            |
| 1/29/65                       |  |           | Nitrogen<br>Tetroxid |                           |              |
|                               | Sample Date  | •         | 1/21/8               | - /21                     |              |
|                               | Sample Batch Number  |           | 1-30                 | 1                         |              |
|                               | Sample Temperature, P  |           | 1-32                 |                           | 3            |
|                               | Sample Specific Gravity  | •         | 1.463                |                           |              |
| ·                             | Met Mil Spec. Requirements (Yes or   | r No)     | YES                  |                           | -            |
| PREPARED BY E. Adams  E. Alul | DATE PERFORMED BY DATE WITNESSED FOR N  E.S. Hribben  14 1/29/65 Lly Killy | 1AA 1/29, | DATE CERTIFIED       | FOR MCDONNELL             | DATE<br>DATE |
| FORM 608-8-39 N               | 1<br>IEW 6-63 .  |           |                      |                           |              |

## INSPECTION DISCREPANCY AND CORRECTION RECORD

Serial No. 4058332 Dwg. No. 208/60-6/

MAKE ENTRY CLEAR AND CONCISE, USE INK

Model\_\_\_\_*SE* →

|  | Ent'd   | DESCRIPTION OF DISCREPANCY AND ACTION TAKEN   | CL             | EARED B                                 | Υ.   |
|--|---|---|----------------|---|--|
| DCP<br>No.                             | By &<br>Date  |   | Mech.          | Lead-<br>mon &                          | Insp.<br>&   |
|  | :07   | CT L III SSFL   | Date           | Date                                    | Date   |
| ,                                      | 12/27   | PART NO. INFO: HIF TEST, IMPULSE SIGNAL WIDTH.  | TEST           | _                                       |  |
| ′                                      | (N.A.)  | WITNESSING WAIVED BY MAC REP. J. MAUROGENIS PE  | R 76           | 1-00A                                   | /  |
|  | ION   | INFORMATION CHILV   |                | 172/61                                  | 12/22/21   |
| TAK                                    | EN  | No ACTION REQUIRED  |                | (A, R/R)<br>(930)                       |  |
|  | 12/2  | PART NO. General NO New Test Procedure sheets re  | ودياوه         | d we                                    | 46   |
| 2                                      | (AVA)   | the book for retesting of the T.C.A. The old a  | 1,00           | SAV                                     |  |
| !                                      |   | doble stumped touted for the retest   |                | 1                                       |  |
| ACT                                    | ION<br>EN   | Information Only  |                | (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) |  |
|  |   |   |                | DEC 2 2 64                              | OEC 2 2 6  |
|  | 12/29/  | PART NO. GENERAL: HOT FIRE TEST IMPULSE SIGNAL WIDT   | H Tax          | A.7.2.                                  | 3.2.3.2  |
| 3                                      | (2)<br>(2)<br>(2)<br>(2)                                    | WITNESSING WALVED BY MAC REP T. MAYREGENIS PER TE   | 4 -Cos1        | 12/28                                   | 164  |
| ACI                                    | ION   | INFORMATION ONLY  |                | T2 9 64                                 | EC 2 9 '64   |
| TAK                                    |   | THE CHAPTER ONLY  |                | (8.50)<br>(9.50)                        | (\$\hat{\text{\$\hat{\\eti}}}}}}}}} \end{\text{\$\hat{\text{\$\hat{\text{\$\hat{\text{\$\hat{\text{\$\hat{\text{\$\hat{\\etitx{\$\etitx{\$\etitt{\$\}}}}}}}}}}}} \etittendegtion \etitt{\$\}\etitt{\$\etitt{\$\etitt{\$\etitt{\$\etitt{\$\}}}}}}}}}}}} \etitten} \etitten} \eti |
|  | 12/29   | PART NO. GENERAL! AN EXTRA TEST WAS RUN BEFORE STA  | RTING          | : Pv                                    | s <i>e</i>   |
| 4                                      | 14<br>(* 34)  | SERIES FOR IMPULSE SIGNAL WIDTH.  |                |   |  |
|  | 986   |   | ı— —           | C.33 7                                  | C. <del></del>   |
| ACT<br>TAK                             | ION   | EXTUR TEST ACCEPTABLE PER   |                | 13/05                                   | 15/5   |
|  |   | IL 4388-5309  |                |   |  |
|  | 165   | PART NO. 208160-61 4N 4058232 DIRING M/F TEST #005 10 ETH   | = 007<br>ERE 1 |   | /o   |
| 5                                      | (3)<br>(3)  | PROPERIANT FLOW.  |                |   |  |
| £#. [                                  | 1000<br>1000<br>1000<br>1000<br>1000<br>1000<br>1000<br>100 | TASTROMED TATTOD TO SICATES THAT PROPERLAD & FROZET - REVISE PROP. TEMPS FROM 15 to 10 10 TF   BUGED PROPELLA SICILIZED TO 15 TO 15 TO 15 TO AND ESTART | ₩ -            | 1465                                    | 1/2/25   |
| ************************************** | CEKOS.  | COLD MODE PULSE REPEATABLETT JA BLUE 1/6/45   | †              | (4×x<br>930)                            | (33)   |

#### ROCKETDYNE

INSPECTION DISCREPANCY AND CORRECTION RECORD

MAKE ENTRY CLEAR AND CONCISE, USE INK

Serial No. 4058232

Dwg. No. 208/60-61

Model

Model SE-7

|            |   | Mo   | del                | SE-7                   |                    |
|------------|---|--|--------------------|------------------------|--------------------|
|            | 5-4'-   | DESCRIPTION OF DISCREPANCY AND ACTION TAKEN  | Cl                 | EARED B                | Υ                  |
| DCP<br>No. | Ent'd<br>By &<br>Date   |  | Mech.<br>&<br>Date | Lead-<br>man &<br>Date | Insp.<br>&<br>Date |
| 6          | 1,45  | PART NO. 208160-61 5/N 405-8232 DURING HIF TEST COS. TO  | 010. 1             | YTO                    |                    |
| ACT<br>TAK | ION   | ANALYSIS OF TEST INTA INDICATES THAT PROPELLANT FROZEAS<br>A RESULT OF UNEQUAL MARDINARE COULING. TESTS CONDUCTED ON A<br>MORE SOFT SCHISTICATED COULING TECHNIQUE INDICATES<br>SATISFACTORY TEMPERATURE CONTROL OR TO TEST. |                    | (330)<br>1/9/15        | (30)<br>1/9/15     |
| 7          | 1/9/  | PART NO. 208160-61 5/N 4658232 DECONTAMINATION COM   | 17267              | TED L                  | פונ                |
| ,          | (A <sup>R</sup> R)<br>(930)   | TO AND INCLUDING PARA. 6.8.35  |                    | 1.77.15                | 1-1-65             |
| ACT        | ION<br>EN   | DICKLAMINATION COMPLETE PARA 6.836 TO 68.41  | •                  | (AN)                   | (ANR)              |
|            |   | PART NO.   |                    | ***                    |                    |
|            |   | Inspection Complete 1/1/65- (3)  |                    |                        |                    |
| AC<br>TAR  | TION<br>(EN   |  |                    |                        |                    |
| 4          | 1/1/25  | PART NO. 208160-61 9/N 4058232 START OF H/F TEST ORC   | 7105               | 4 24°F                 |                    |
| 0          | (A) R<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S<br>(B) S | FLOW WAS OBSERVED. ON CHART, PROPELLANTS AND I   | <u>wee:</u>        | TOR FA                 | re<br>C            |
| AC<br>TAI  | TION  | Made tacility changes to sontrol all<br>Tacala 896-388<br>-temperatures at 20° CK to resume testing  | <i>/-</i>          | 16-                    | 65<br>33           |
| 9          |   | PART NO. 208160-61 FN 4058232 START OF HIF TEST 02.  |                    | NT                     | 0                  |
|            | TIÓN<br>KEN   | TRANSERRED TO SHORTAGE   | 7                  | J 78                   | \$5<br>(3)         |

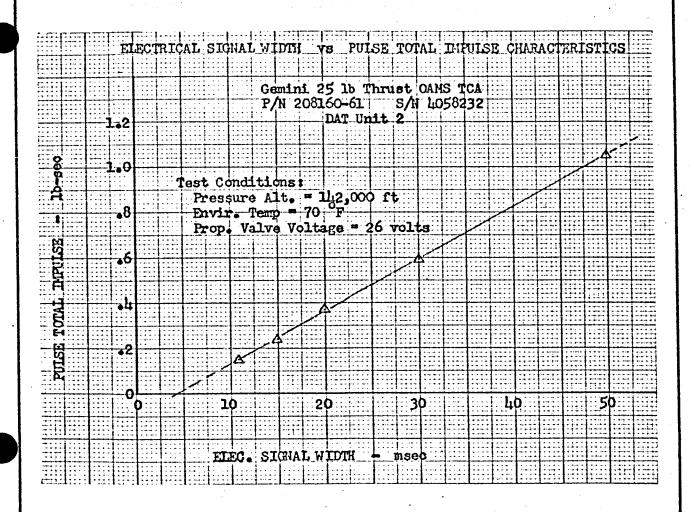
#### ROCKETDYNE

| COMPONENT NAME THRUST CHAMBER ASSERBLY | - 25# | PART           |       | NC_52 <b>-</b> 52<br>NA_208] | <u>701-265</u><br>60-61 | <u> </u> |
|--|-------|----------------|-------|------------------------------|-------------------------|----------|
| NAME OF TEST IMPULSE_SIGNAL WIDTH TEST |       | TEST           |       |                              | ETC                     | )F       |
| TEST PHASE: Impulse vs Signal Survey   | •     |                | •     |                              |                         | •        |
| Volts = 26<br>Temp. = 70 Pulse Number  | ,     | 2              | 6     | 8                            | 12                      | Avg      |
| Signal Width, msec                     | 10.8  | 10.8           | 10.5  | 10.8                         | 10.9                    | 10.8     |
| Ignition Time, msec                    | 12.6  | 12.7           | 8.0   | 20                           | 7.5                     | 9.6      |
| Rise Time, msec                        | 4.2   | 5.0            | 3,9   | 5.0                          | 4.4                     | 4.5      |
| Effective Firing Time, msec            | 4.4   | 3.2            | 4.5   | 4,3                          | 4.6                     | 4.2      |
| Out-Off Time, msec                     | 22    | 9.0            | 8.1   | 8.0                          | 7.4                     | 8.3      |
| Decay Time, msec                       | 2.9   | 3.8            | 2.1   | 24                           | 1.7                     | 2.6      |
| Shutdown Impulse, 1b-sec               | 1412  | 1309           | 1349  | 1296                         | 1316                    | 1336     |
| Pulse Total Impulse, 1b-sec            | 1556  | 1497           | 1429  | 1520                         | 1531                    | .1512    |
| Mean Specific Impulse, sec             | 144.5 | 142.2          | 149.4 | 136.2                        | 146.4                   | 144.8    |
| Volts = 26<br>Temp. = 70° Pulse Number | 2     | 5              | 7     | 9                            | 12                      | Avg      |
| Signal Width, mseç                     | 15,2  | 15.1           | 14.8  | 14.8                         | 14.8                    | 14.9     |
| Ignition Time, msec                    | 4.2   | 7.7            | 7.7   | 7.2                          | 7.3                     | 6.9      |
| Rise Time, msec                        | 4.2   | 5.8            | 5.0   | 6.0                          | 4.7                     | 5.1      |
| Effective Firing Time, msec            | 7.0   | 6,8            | 8.1   | 6.0                          | 7.6                     | 7.1      |
| Cut-Off Time, msec                     | 10.9  | 8.4            | 9.8   | 9.6                          | 9.8                     | 9.7      |
| Decay Time, msec                       | 5.5   | 3.0            | 3.8   | 4.5                          | 5.0                     | 4.4      |
| Shutdown Impulse, 1b-sec (.260 max)*   | 1628  | 1376           | 1643  | 1530                         | 1411                    | 1518     |
| Pulse Total Impulse, 1b-sec            | .2382 | ,2245          | .2528 | .2431                        | 2438                    | 2405     |
| Mean Specific Impulse, sec (235 min)   | 183.2 | 165.3          | 185.1 | 180.2                        | 178.3                   | 178.4    |
| Volts = 26<br>Temp. = 70° Pulse Number | 2-    | 3              | 4     | 7                            | 8                       | Avg      |
| Signal Width, msec                     | 19.7  | 20.1           | 20.1  | 19.8                         | 19.9                    | 19.9     |
| Ignition Time. msec                    | 8.7   | 7.3            | 6.8   | 6.8                          | 6.7                     | 7.3      |
| Rise Time, msec                        | 5.6   | 6.1            | 6.2   | 6.3                          | 5.9                     | 6.1      |
| Affective Firing Time, msec            | 11.0  | 12.3           | 12.6  | 12.6                         | 12.6                    | 12.2     |
| Cut-Off Time, msec                     | 11.6  | 11.3           | 10.9  | 1112                         | 10.9                    | 11.2     |
| Decay Time, msec                       | 5.9   | 5.6            | 4.2   | 5.2                          | 5.5                     | 5.4      |
| Shutdown Inpulse, 1b-sec               | 1247  | 1406           | 1698  | 1624                         | 1479                    | 1631     |
| Pulse Total Impulse, 1b-sec            | 13449 | para structure | 3657  | ~-~                          | 3766                    | 3710     |
| Mean Specific Inpulse, sec             | 2047  | 2010           | 196.6 | 205.4                        | 211.9                   | 203.9    |
| * Ref: ECN NA-SE6-289Rl                | 111   |                | A     |                              | ha by                   | <u></u>  |
| repared by: Cherked by:                | tel 1 | 1              | Appro | 787代2                        | Gra by                  | \$       |
| FORM 608-B-37 NEW 6-63                 | -     |                | 11    | 100                          |                         |          |

|                                  |  |              |           | •                         |                    |              |        |
|----------------------------------|--|--------------|-----------|---------------------------|--------------------|--------------|--------|
| COMPONENT NAME THRUST CHANDER    | ASSE BLY                               | - 25#        | PART      | NO & M                    | ac 52-57           |              | 5      |
| ,                                |  |              |           | UN                        |                    | 160-61       |        |
| NAME OF TEST IMPULSE SIGNAL WIDT | H TEST                                 | ····         | TEST      | NO2083                    | 160-48th           | EET          | OF     |
| TEST MIASE: Impulse vs Signal S  | urvev (                                | cont.(d)     |           |                           |                    |              |        |
| •                                |  | u,           |           |                           |                    |              |        |
| Volts = 26                       | 1_3 :: 37.                             | 1            | •         |                           | -                  | <del> </del> |        |
| Temp. = 70° Pulse                | llumber                                | 2            | 5         | 6                         | 8                  | 9            | Avg    |
| Signal Width, msec               |  | 30.1         | 30.1      | 30.0                      | 29.9               | 29.9         | 30.0   |
| Ignition Time, msec              |  | 6.8          | 7.8       | 7.7                       | 8.2                | 7.8          | 2.7    |
| Rise Time, nsec                  |  | 6.7          | 5.3       | 5.9                       | 4.4                | 5.2          | 5.5    |
| Effective Firing Time, msec      |  | 21.3         | 21.9      | 21.7                      | 23.2               | 22.5         | 22.1   |
| Out-Off Time, nsec               |  | 11.4         | 10.7      | 10.4                      | 10.6               | 9.9          | 10.6   |
| Decay Time, msec                 |  | 6.7          | 5.7       | 5.0                       | 40                 | 4.2          | 5.3    |
| Shutdown Impulse, 1b-sec         |  | 1595         | 1536      |                           | 1710               | 1691         |        |
| Pulse Total Impulse, 1b-sec      |  |              |           | 5956                      |                    | 6089         | .5980  |
| Mean Specific Impulse, sec       |  | 222.3        | 221.1     | 220.0                     | 224.8              | 229.8        |        |
| Volts = 26                       | ************************************** | A KANANANANA | Markensus | Personal Property Control | PROFESSION AND CO. |              |        |
| Temp. = 70° Pulse                | llumber                                | ,            | 3         | 5                         | 7                  | 10           | Avg    |
|                                  |  | CONTRACTOR   | -         | -                         |                    |              |        |
| Signal Width, msec               |  | 19.8         | 50.1      | 49.9                      | 49.8               | 49.7         | 49.9   |
| Ignition Time, msec              | •                                      | 2.9          | 6.8       | 7.7                       | 7.8                | 2.7          | 7.6    |
| Rise Time, msec                  |  | 8.1          | bel       | 6.8                       | 7.0                | 7.3          | 7.0    |
| Effective Firing Time, msec      |  | 39.0         | 41.5      | 39.8                      | 40.0               | 40.2         | 40.1   |
| Cut-Off Time, msec               |  | 13,2         | 10.2      | 10.4                      | 9.4                | 7.6          | 10.2   |
| Decay Time, msec                 |  | 8.0          | 6.0       | 6.0                       | 5.5                | 2.0          | 5.5    |
| Shutdown Impulse, 1b-sec         | <del></del>                            | 1974         | .1656     | 1606                      | 14.70              | 1222         | 1696   |
| Pulse Total Impulse, 1b-sec      | · · · · · · · · · · · · · · · · · · ·  | 1.076        |           | 1.044                     |                    | 1.059        | 1.056  |
| Mean Specific Impulse, sec       | ·                                      | 248.9        | 245.4     | 744.0                     | 244.2              | 246,3        | 245.8  |
| Volts = 26                       | Radick Printer                         |              | HALLERY   | A                         | -                  |              |        |
| Temp. = 70° Pulse                | Munber                                 | 1            | 2         | 5                         | 6                  | 8            | Avg    |
| Signal Width, msec               |  | 99.8         | 100.3     | 99.8                      | 19.8               | 99.8         | 99.9   |
| Ignition Time, msec              |  | 7.7          | 7.0       | 8.5                       | 8.0                | 7.0          | 7.6    |
| Rise Time, msec                  |  | 5.2          | 8.5       | 5,0                       | 5.5                | 7.0          | 6.2    |
| Affective Firing Time, msec      |  | 91.5         | 88.5      | 87.0                      | 91.5               | 90.5         | 90.2   |
| Cut-Off Time, msec               |  | 10.7         | 10.2      | 11.6                      | 9.5                | 10.3         | 10.5   |
| Decay Time, msec                 |  |              | 6,5       | 7.2                       | 4,2                | 6.0          | 6.0    |
| Shutdown Impulse, 15-sec         |  |              | 1510      | 1435                      | 1779               | 1589         |        |
| Pulse Total Impulse, 1b-sec      |  | 1            |           | 2.222                     | 2 221              |              | 1651   |
| Mean Specific Lipulse, sec       |  | 264.4        | 263.4     | 265.7                     | 262.8              | 263.5        | 2640   |
| •                                |  |              |           | /                         |                    |              | - 1952 |
| Prepared by:                     | ed by://                               | 111-1        |           | IAppro                    | la le              | 77 X ==      |        |
| 2 Je lunsan                      |  | y Mit        | ELXA      | I Who Lob                 | o'FXY'             | Car on       |        |
| FORM 608-B-37 NEW 6-63           |  | ,            | -         |                           | Lun                |              |        |
| <b>₹</b>                         | •                                      |              |           | ,                         | ٧.                 |              |        |

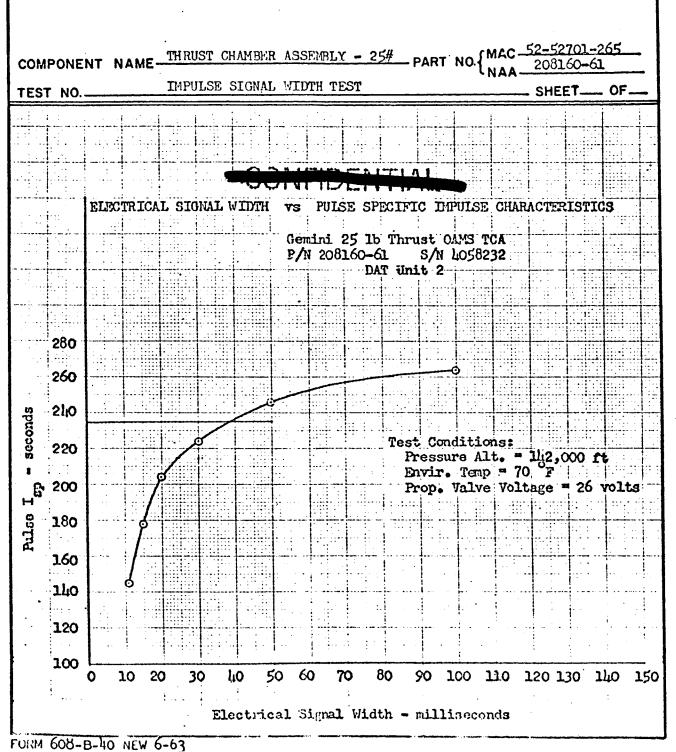
#### ROCKETDYNE

#### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM



|              |         |                   |      | <u> </u>                |      |
|--------------|---------|-------------------|------|-------------------------|------|
| PREPARED BY: | DATE    | APPROVED FOR NAA: | DATE | APPROVED FOR MCDONNELL: | DATE |
| 13/ Deliver  | 9/24/15 | 1,10              | //_  |                         |      |
| CHECKED BY:  | DATE    | Me I Well         | 70   |                         | _    |
| MAIC         |         |                   | ~ // |                         |      |

FORM 608-B-38 NEW 6-63



R-15019-2

| COMPONENT NAME THRUST CHAMBER ASSETBLY - 25// PART NO MAC 52-52701-265 |         |       |       |       |       |        |  |  |
|--|---------|-------|-------|-------|-------|--------|--|--|
| NAME OF TEST TEST NO208160-401 OF                                      |         |       |       |       |       |        |  |  |
| TEST FLASE: Signal Width Repeatability at Ambient Temperature          |         |       |       |       |       |        |  |  |
| olts = 22<br>Temp. = 70° Pulse Number                                  | ,       | 3     | 5     | 7     | 8     | · Avg  |  |  |
| Signal Width, msec   | 14.1    | 14.3  | 14.3  | 14.2  | 14.1  | 14.2   |  |  |
| Ignition Time, msec  | 8.5     | 8.5   | 8.0   | 8.5   | 8.5   | 8.4    |  |  |
| Rise Time, msec  | 8.6     | 6.9   | 6.7   | 4.8   | 4.5   | 2.1    |  |  |
| Effective Firing Time, msec  | 6.0     | 7.5   | 7.6   | 2.2   | 8.1   | 7.4    |  |  |
| Sut-Off Time, msec   | 11.1    | 7.7   | 7.8   | 8.0   | 8.1   | 8.5    |  |  |
| Docay Time, nsec   | 4.6     | 4.6   | 4.2   | 4.1   | 3.7   | 4.2    |  |  |
| Shutdown Impulse, 1b-sec   | 1590    | 1634  | 1450  | 1567  | 1469  | 1542   |  |  |
| Pulse Total Empulse, 1b-sec  | 2157    | 2249  |       | 2253  |       | .2195  |  |  |
| Mean Specific Impulse, sec   | 159.3   | 158.2 | 163.1 | 171.5 | 159.8 | 162.4  |  |  |
| Yolts = 26<br>Temp. = 70° Pulse Number                                 | 2       | 3     | 8     | //    | 12    | Avg    |  |  |
| Signal Width, msec   | 15.1    | 14.9  | 14.8  | 15,2  | 15.2  | 15.0   |  |  |
| Ignition Time, msec  | 8.6     | 7.7   | 8.3   | 8.6   | 8.3   | 8.3    |  |  |
| Rise Time, msec  | 4.6     | 6.9   | 5.9   | 4.4   | 4.4   | 5,2    |  |  |
| Effective Firing Time, msec  | 6.6     | 5.7   | 6.0   | 6.8   | 7.3   | 6.5    |  |  |
| Cut-Off Time, msec   | 9.1     | 9.3.  | 9.9   | 9.8   | 6.7   | 9.0    |  |  |
| Decay Time, msec   | 2.5     | 1.8   | 2./   | 2.5   | 2.2   | 2.3    |  |  |
| Shutdown Impulse, 1b-sec (.260 max) *                                  | 1405    | 1427  | 1503  | 1417  | 1306  | 1412   |  |  |
| Pulse Total Impulse, 1b-sec  | 2248    | 2250  | 2471  | 2683  | 2493  |        |  |  |
| Mean Specific Impulse, sec (235 min)                                   | 168.7   | 163.5 | 170.2 | 174.5 | 174.4 | 170.3  |  |  |
| Volts = 30<br>Tap. = 70° Pulse Mumber                                  | 4       | 5     | 7     | 9     | 71    | Avg    |  |  |
| ignal Width, msec  | 16.9    | 16.9  | 12.1  | 16.9  | 17.1  | 17.0   |  |  |
| mition Time, msec  | 8.2     | 8.2   | 8.7   | 26    | 6.3   | 7.8    |  |  |
| Rise Time, msec  | 5.8     | 5.8   | 4.5   | 6.9   | 6.2   | 5.8    |  |  |
| Affective Firing Time. msec  | 7.2     | 2.2   | 7.4   | 6.4   | 8.0   | 2.2    |  |  |
| Cut-Off Time, msec   | 10.0    | 9.6   | 10.0  | 9.6   | 10.3  | 9.9    |  |  |
| Decay Time, msec   | 3.4     | 5.2   | 4.3   | 3.0.  | 4.5   | 4.1    |  |  |
| Shutdown Empulse, 1b-sec   | 1597    | 1450  | 1549  |       | 1600  | 1574   |  |  |
| Pulse Total Impulse, 1b-sec  |         |       |       |       |       | 27ex   |  |  |
| Mean Specific Empulse, sec   | 121.4   | 171.2 | 172.8 | 169.3 | 176,0 | 172,2  |  |  |
| * Ref: ECN NA-SE6-289R1 Propared by: Checked by Apopy Apopy            |         |       |       |       |       |        |  |  |
| FORM 600-B-3/ NEW 6-63   | <i></i> | 1     | 1     | 120-  |       |        |  |  |
|  |         |       |       |       | 0.3   | 8010 O |  |  |

#### BOCKEIDAME

| į,                                       |                |                 |             |                     |             |       |
|--|----------------|-----------------|-------------|---------------------|-------------|-------|
| COMPONENT NAME THRUST CHAMBER ASSEMBLY   | - 25%          | PART            | NO CM       | 1c_52-52            | 701-26      | 5     |
| COM CITETY NAME TO SEE STATE ROOMED STA  |                | PARI            | NO. E NA    | NC_52-52<br>NA_2081 | 160-61      |       |
| NAME OF TEST MPILSE SIGNAL WIDTH TEST    |                | TEST            |             | 160-4874            |             |       |
| TEST MIASE: Signal Width Repeatability ( | Hot Mod        | е)              |             |                     | <del></del> |       |
| Volts = 22<br>Temp. = 160 Pulse Number   | ,              | 5               | 8           | 10                  | 12          | Avg   |
| Signal Width, msec                       | 12,9           | 12.8            | 12.8        | 12.9                | 13.2        | 12.9  |
| Ignition Time, msec                      | 8.7            | 8.7             | 7.8         | 8.8                 | 9.7         | 8.7   |
| Rise Time, msec                          | 5.9            | 4.6             | 6.4         | 5.2                 | 4.9         | 5.8   |
| Effective Firing Time, msec              | 3.6            | 3.1             | 3.8         | 3.5                 | 3.4         | 3.5   |
| Out-Off Time, msec                       | 14.7           | 15.2            | 15.1        | 15.1                | 15.0        | 15.0  |
| Decay Time, msec                         | 9.4            | 9.6             | 9.9         | 10.5                | 10.2        | 9.9   |
| Shutdown Impulse, 1b-sec                 | 1669           | 1686            | 1647        | .1569               | 1607        | 1636  |
| Pulse Total Impulse, 1b-sec              | 2093           | 2020            | 2114        | ,2029               | ,2007       | .2053 |
| Mean Specific Impulse, sec               | 127.5          | 171.3           | 176.4       | 170.3               | 173.9       | 173.9 |
| Volts = 26                               | -              | - arminalisetan | -           |                     | -           |       |
| Temp. = 160° Pulse Humber                | 2              | 5               | 7           | 9                   | 10          | Avg   |
| Signal Width, msec                       | 14.7           | 14.9            | 14.9        | 14.8                | 14.8        | 14.8  |
| Ignition Time, msec                      | 8.3            | 8.7             | 8.3         | 8.3                 | 8.7         | 8.5   |
| Rise Time, msec                          | 6.0            | 5.0             | 6.0         | 5.2                 | 5.3         | 5.5   |
| Effective Firing Time, maec              | 5.5            | 5.7             | 5.0         | 6.0                 | 5.5         | 5.5   |
| Cut-Off Time, msec                       | 14.7           | 15.1            | 15.0        | 14.5                | 13.9        | 14.6  |
| Decay Time, msec                         | 9.6            | 10.6            | 10.6        | 9.8                 | 9.2         | 10.0  |
| Shutdown Impulse, 1b-sec                 | 1686           | 1648            | 1603        | 1714                | 1697        | 1670  |
| Pulse Total Impulse, 1b-sec              | 2547           | .2570           | 2540        | .2588               | 2556        | .2560 |
| Mean Specific Impulse, sec               | 189.2          | 179.9           | 185.4       | 186.6               | 190.2       | 186.3 |
| Volts = 30 Temp. = 160° Pulse Mumber     | 5              | 7               | 9           | 11                  | 12-         | Avg   |
| Signal Width, msec                       | 16.0           | 16.1            | 16.1        | 16.1                | 16.1        | 16.1  |
| Ignition Time, msec                      | 8.6            | 9.1             | 7.6         | 8.6                 | 8.9         | 8.8   |
| Rise Time, msec                          | 5.8            | 5.9             | 5.9         | 6.9                 | 7.1         | 6.3   |
| Effective Firing Time, msec              | 5,5            | 4.5             | 6.0         | 5.0                 | 5.1         | 5.2   |
| Cut-Off Time, msec                       | 14.6           | 15.0            | 14.5        | 14.7                | 15.1        | 14.8  |
| Decay Time, msec                         | 10,8           | 11.4            | 11.0        | 10.2                | 10.1        | 10.7  |
| Shutdown Impulse, 1b-sec                 | 1484           | 1639            | .1551       | 1749                | 1797        | 1644  |
| Pulse Total Impulse, 1b-sec              | 2549           |                 |             | 2774                |             | 2666  |
| Mean Specific Impulse, sec               | 185.8          | 177.4           | 1           | 194.5               | 172.2       | 184.0 |
|  |                |                 | <del></del> | ^ .                 |             |       |
| Prepared by! Checked by?                 | I Ven          | 51              | Approv      | 快快                  | राधिया      | :     |
| FORM 608-B-37 NEW 6-63                   | السلسة الماسية | 7               |             | 1190                |             |       |

| COMPONENT NAME THRUST CHAMBER ASSEMBLY       | - 25/   | _ PART |        | c 52-52 |         |       |
|--|---------|--------|--------|---------|---------|-------|
| NAME OF TEST IMPLIES SIGNAL WIDTH TEST       |         | TEST   | NO2081 | 1 03    |         | F     |
| . TEST PHASE: Signal Width Repeatability (Co | old Nod | e)     |        |         |         |       |
| Volts = 22<br>Temp. = 20 Pulse Number        | /       | 2      | 7.     | 9       | 10      | Avg   |
| Signal Width, msec                           | 13.0    | 12.8   | 12.9   | 13.0    | 12.9    | 12.9  |
| Ignition Time, msec                          | 9.3     | 9.2    | 8.7    | 8.3     | 8.4     | 8.8   |
| Rise Time, msec                              | 6.7     | 5.0    | 4.9    | 1.5     | 5.3     | 5.7   |
| Effective Firing Time, msec                  | 3.4     | 5.0    | 4.8    | 3.4     | 4.3     | 4.2   |
| Out-Off Time, msec                           | 11.2    | 8.4    | 9.3    | 9.2     | 9.1     | 9.4   |
| Decay Time, msec                             | 4.9     | 2.1    | 3.8    | 4.0     | 4.0     | 3.8   |
| Shutdown Impulse, 1b-sec                     | 11551   | 1656   | 1555   | .1406   | 1507    | 1535  |
|  | 1830    | 2027   | 1900   | 1871    |         | 1928  |
| Mean Specific Impulse, sec                   | 137.1   | 157.0  | 152.7  | 145.5   | 164.2   | 151.3 |
| Volts = 26<br>Temp. = 20 Pulse Number        | 2       | 4      | 7      | 9       | 11      | Avg   |
| 1.mp 50                                      |         |        |        |         |         |       |
| Signal Width, msec                           | 13.3    | 13.3   | 13.3   | 13.3    | 13.3    | /3.3  |
| Ignition Time, msec                          | 8.5     | 6.8    | 7.3    | 7.7     | 7.2     | 7.6   |
| Rise Time, msec                              | 4.8     | 4.7    | 7.5    | 4.0     | 5.6     | 5.2   |
| Effective Firing Time, msec                  | 7.2     | 7.3    | 6.0    | 6.0     | 6.1     | 6.5   |
| Cut-Off Time, msec                           | 9.8     | 10,0   | 9.5    | 9.6     | 10.6    | 9.9   |
| Decay Time, msec                             | 2.6     | 4.5    | 2,0    | 3.2     | 4.5     | 3.4   |
| Shutdown Impulse, 1b-sec                     | 1880    |        | 1856   |         | 1243    | 1222  |
| Pulse Total Impulse, 15-sec                  | 2423    | 2595   | 2534   | 12432   | 2340    | 2465  |
| Mean Specific Impulse, sec                   | 1       | L      | L      | l       |         |       |
| Volts = 30<br>Temp. = 20 Pulse Number        | 3       | 4      | 6      | 8       | 11      | Avg   |
| Signal Width, msec                           | 16.9    | 16.9   | 16.8   | 17.0    | 17.0    | 16.9  |
| Ignition Time, msec                          | 9.1     | 8.6    | 7.5    | 6.6     | 8.5     | 8.1   |
| Rise Time, msec                              | 5.7     | 6.8    | 6.5    | 8.1     | 6.6     | 6.7   |
| Affective Firing Time, msec                  | 6.5     | 6.5    | 8.1    | 7.4     | 6.9     | 7.1   |
| Cut-Off Time, msec                           | 9.4     | 8.7    | 8.1    | 7.6     | 8.0     | 8.4   |
| Decay Time, msec                             | 5.0     | 3.6    | 2.8    | 2,4     | 2.9     | 3.3   |
| Shutdown Inpulse, 15-sec                     | 1379    |        | 1565   | 1529    | 1486    | 1486  |
| Pulse Total Impulse, 1b-sec                  | 2469    | T      | 2845   | 1       |         |       |
| Mean Specific Impulse, sec                   | 185.7   | 1 -    | 181.4  | 1       |         | 127.3 |
|  | 1-1     | ·      | ·      | vgc216F | ,       | •     |
| Prepared by Checker by                       | W. STV  |        | Argan  | Por lor | With by | *     |
| FORM 608-B-37 NEW 6-63                       | 1000    | 177    | K      | 100     |         |       |

|                  | THRUST CHAMBER ASSEMBLY - 25# PART NO. \( \begin{array}{c} MAC \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \   |
|------------------|--|
| NAME OF TEST_DAT | DUTY CYCLE TO 160 SECONDS TEST NO 208260— SHEET 3130F 380  |
| Reference:       | MAC SCD 52-52701, Revision F, Paragraph 6.3.1.3.2.2  |
| 7.2.4            | DAT Duty Cycle to 160 Seconds - TCA #2   |
| 7.2.4.1          | Test Procedure   |
| 7.2.4.1.2        | Perform DAT Duty Cycle Firing Test per paragraph 6.7 and Table II. The TCA shall be fired for an accumulated duration of 160 seconds without catastrophic failure. |
| 7.2.4.1.3        | Perform decontamination per paragraph 6.8.   |
| 7.2.4.1.4        | Reduce data per SEM 4388-4040.   |
| 7.2.4.1.4.1      | The results of significant data shall include but not be limited to the following:   |
| 7.2.4.1.4.1.1    | Graphical presentation of temperature versus time for all TCA thermocouple locations.  |
| 7.2.4.1.4.1.2    | Graphical presentation of total impulse versus signal width.   |
| 7.2.4.1.4.1.3    | Graphical presentation of mean specific impulse versus signal width.   |
| 7.2.4.1.5        | Perform weight determination per paragraph 6.6.  |
|                  |  |

| PREPARED BY: | DATE    | APPROVED FOR NAA: | DATE    | APPROVED FOR MCDONNELL:  | DATE |
|--------------|---------|-------------------|---------|--|------|
| R.Cole       | 1-27-65 |                   |         | The state of the s | UATE |
| CHECKED BY:  | DATE    | Bleise            | 1-28-65 |  |      |
| Ja San       | 1/28/65 | 1 W Course        |         |  |      |

FORM 608-3-38 NEW 6-63

| COMPONENT NAM  | E THRUST CHAMBER ASSEMBLY - 25# PART N                      | I MILL.                              | 2-52701-265<br>08160-61 |
|--|---|--------------------------------------|-------------------------|
| NAME OF TEST   | B   | LNAA                                 | 01<br>SHEET 31/OF 380   |
| . 2.4.2  | Tost Data - TCA #2.   | •                                    |                         |
| 7.2.4.2.1  | Component Identification                                    |                                      |                         |
| •  | Component Name TCF  |                                      |                         |
| •  | McDonnell Part No. 52-52701-20                              | شح                                   |                         |
| •  | Rocketdyne Part No. 208/60-61                               |                                      |                         |
|  | Component Serial No. <u>405823</u> 2                        |                                      |                         |
|  | Accumulated Acceptance Test Firing Time,                    | seconds 19                           | 1.75                    |
| •<br>Programme to the second second second second second second second second second second second second second se<br>Programme second secon |   | Pre-Test                             | Post Test               |
| •  | Throat Diamster, inches (Average of four measurements)      | :3578                                | 3532                    |
|  | Nozzle Exit Diameter, inches (Average of four measurements) | 2.261                                | 2.458                   |
| 7.2.4.2.2  | Propellant Samples  | ************************************ |                         |
| •  |   | Nitrogen<br>Tetroxide                | Monomethyl<br>Hydrazine |
|  | Sample Date   | 1/27/65                              | - 1/27/65               |
|  | Sample Batch Number   | 1-324                                | 1-3,23                  |
|  | Sample Temperature, F                                       | 66° F                                | 72°F                    |
| • .  | Sample Specific Gravity                                     | 1.465                                |                         |
|  | Met Mil Spec. Requirements (Yes or No)                      | YES.                                 | yES                     |
| PREPARED BY  B. Adens  | DATE PERPORMED BY DATE WITNESSED FOR NAA DA                 | Janus D.                             | OR MCDONNELL DATE       |
| 24 4/14  | 64 ( CC LOVE 1-28-65 )                                      | VERIFIED D                           | Y CALLAND TO THE        |
| FORM 603-B-39 1  | EW 6-63   |                                      | 7                       |

| 2.4.2.4       | DAT DUTY CYCLE TO 160 SECONDS TEST NO. 208160_ SHEET 3150F 38  DAT Duty Cycle Data (reference paragraph 7.2.4.1) |
|---------------|--|
| -             | Test Cell Location   |
|               | Test Cell Number 39 T  |
|               | Test Number <u>037</u>   |
| e<br>Postaj e | Test Date 1/29/65  |
| ** <u>*</u>   | NOTE: All data corrected to Standard Vacuum conditions.  |
|               |  |
|               |  |
|               |  |

## IRECO CIRCIE TO TO INSPECTION DISCREPANCY AND CORRECTION RECORD

Serial No. <u>#058232</u> Dwg. No. <u>208/60-6/</u>

MAKE ENTRY CLEAR AND CONCISE, USE INK

Model SE-7

|          |               | DESCRIPTION OF DISCREPANCY AND ACTION TAKEN   | CL          | EARED B                                      | Υ        |
|----------|---------------|---|-------------|--|----------|
| DCP      | Ent'd<br>By & |   | Mech.       | Lead-  | Insp.    |
| No.      | Date          |   | &           | man &  | &        |
|          |               |   | Date        | Date   | Date     |
|          |               | PART NO.  |             |  |          |
|          |               |   |             |  |          |
|          |               | to dealt place of   | 77          |  | 1        |
|          |               | JANGULEN COMPULE 7038 CIZZ  | <del></del> |  |          |
|          |               | Inspection Complete D/056 CTLI  | =           |  |          |
|          |               |   |             |  |          |
|          | ION           |   |             |  |          |
| TAK      | EN            |   |             |  |          |
|          |               |   |             |  |          |
| 1        | 29            | PART NO. 208160-61 \$1 405823.2 SKIN TEMP. EXCEEDED S   |             | 720  | 306      |
| 15       | 65            | 208760-61 /N 403823.2 3KIN TEMP. EXCEEDED 3   | 30 F        |  | URE      |
| 10       | (Na)          | 116 SEC. ACCON FIRING TIME, REF. TABLE II NOTE (2)  |             |  | 1        |
|          | (36)          |   |             | -  |          |
|          | <u> </u>      |   | . – – .     | r —  |          |
|          |               |   |             | (A)  |          |
|          | ION           | Parsfelled to shortage  |             |  | (9.7)    |
| TAK      | EN            | J V   | ١,          | 1/20/  | ا سا     |
|          |               |   | <del></del> | ¥ £9/1                                       | $\omega$ |
| Ħ        | 39/           | PART NO. 208160-61 S/N 4058232 SKIN TEMP. EXCEEDED  | 7000        | F RE   | FORE     |
|          | 165           |   | ,           | \<br>\                                       |          |
| 11       | (AN)          | 134 SEC. ACCUM FIRING TIME. REF. TABLE IL NOT   | F (3        | <u>}                                    </u> |          |
|          | હ્યું         |   |             |  | ı        |
|          | <u></u>       |   | ı           |  | 11       |
| AC       | TION          | Transfelled to Shollage   | •           |  | (2/3)    |
| TAI      | KEN           | X Y   |             | 1  | V = 1    |
|          |               |   | <u> </u>    | 1/29/  | 155      |
| (        | (3)           | PART NO   |             | ·  |          |
| #        | 1//           | part NO. 308160-61, 3/1/158232 - lost fest insp leder wraterial cloded, delanunating i chacking | 7/5         | <u>ab/ē</u>                                  | FISE     |
|          | 129/          | intaint contait definition is acretic   |             | ٠.   |          |
|          | 1%            | MATERIAL CLOUPA, RITANUNATING & CLACKIN   | 9.          |  |          |
|          | 145           |   |             |  |          |
|          |               |   | 1           | (A)3)  | (E)      |
|          | TION          | TRANSFELLED to Shortage   | 4           | (2)  | (3)      |
| '^'      | <b>VEI 4</b>  | 8   | 1           | 1//  | 1_ 1     |
| <u> </u> | 1/2:          |   |             | V39/0  | 45       |
|          |               | PART NO 208160 61 5/2 4658232 - 1658 4558 INS. P.   | ال سام      | 2/2  |          |
| 12       | 1/            | 00 5 100 61, 5/N 463 8 532 - 11 31 12 31 12 51  | 17.00       | 8/5  |          |
| 3        | 129/          | Exidence of excessive heat as indica  | ted         | _bu  | ,        |
| 1        | 15            | , 08  |             | /  |          |
| <b> </b> | <u> </u>      | - Miscolofation - of - a - fel thort - of telien  | I           | /C   | .,       |
| 1        | TION          |   | 1 '         | ANR  | (48)     |
| 1 -      | KEN           | Marghelled to Shortage  | +           | 学  |          |
|          |               |   | 1           | 1/10/  | 1-       |
| bearan   |               |   | <u></u>     | 2010/0                                       | 170      |

| COMPONENT NAME THRUST CHAIBER ASSETBLY - 25#         | PART NO. {  | AC 52-5270<br>AA 208160 |          |
|--|-------------|-------------------------|----------|
| NAME OF TEST DAT DUTY CYCLE TO 160 SECONDS           | TEST NO.200 | TON- SHEE.              | T0F      |
| Sequence Number/                                     |             | •                       | ·        |
| Pulse Number   | 2           | 16                      | 34       |
| Signal Width, msec                                   | 27.7        | 27.4                    | 300      |
| Start Time, msec (25 max.)                           | 13.5        | 13,3                    | 14.0     |
| Environmental Pressure, psia                         | .013        | .013                    | .013     |
| Environmental Temperature, or                        | 70          | 70                      | 70       |
| Oxidizer Inlet Temperature, oF                       | . 70        | 70                      | 70       |
| Fuel Inlet Temperature, or                           | 70          | 70                      | 70       |
| Oxidizer Inlet Pressure, psia                        | 292         | 292                     | 292      |
| Fuel Inlet Pressure, psia                            | 292         | 292                     | 292      |
| Total Oxidizer Flow, Iba                             | .00135      | 00133                   | .00148   |
| Total Fuel Flow, lbs                                 | .00105      | .00105                  | 00114    |
| Mean Mixture Ratio, o/f                              | 1.287       | 1,270                   | 1.300    |
| Pulse Total Impulse, 1b-sec                          | .5470       | .5389                   | .5977    |
| Mean Specific Impulse, sec                           | 227.8       | 226.4                   | 227.8    |
| Shutdown Impulse, 1b-sec (.260 max) *                | .1857       | .1613                   | .1569    |
| Cut-Off Time, msec                                   | 12.4        | 1/,3                    | 10.7     |
| Oxidizer Valve Voltage, volts                        | 26          | 26                      | 26       |
| Fuel Valve Voltage, volts                            | 26          | 26                      | 26       |
| Oxidizer Valve Current, amps                         | .645        | .645                    | .645     |
| Fuel Valve Current, amps                             | .639        | .639                    | .639     |
| Electrical Power, watts                              | 33.4        | 33.4                    | 33.4     |
| * Ref: ECN NA-SE6-289R1.                             |             |                         |          |
| Prepared by:  13 / Rolinson  FC:01 608-B-37 NEW 6-63 | Appi        | My Oc.                  | JASC by: |
| FC:::1 608-8-37 NEW 6-63                             | /           | 1                       |          |

R-15019-2

| COMPONENT N  | AME THRUST PRAIRIER ASSEMBLY - 25#  | PART NO NAA                               | 208160-61               |
|--------------|---|---|-------------------------|
| NAME OF TEST | DAT LUTY CYCLE TO 160 SECOIDS   | TEST NO. 20316                            | 1.67                    |
| •            | Sequence Number 2 Pulse Number /  | Site                                      | Standard                |
|              | Firing Duration, sec Accumulated Firing Time, sec   | <u> </u>                                  | Vacuum                  |
|              | Data Slice Number Time of Data Slice, sec Environmental Pressure, psia  | 4.0                                       | •                       |
|              | Environmental Temperature, <sup>O</sup> F  Oxidizer Temperature, <sup>O</sup> F  Fuel Temperature, <sup>O</sup> F | 41 (VA                                    | e. Chumber)<br>70       |
|              | Oxidizer Inlet Pressure, psia<br>Fuel Inlet Pressure, psia  | <u>59</u><br><u>294.4</u><br><u>294.4</u> | 70<br>292<br>292        |
| •            | Oxidizer Flowrate, lbs/sec Fuel Flowrate, lbs/sec Mixture Ratio, o/f (1.30+6%)                                    | .0470<br>.0355                            | .0464<br>.0353<br>.1,31 |
|              | Thrust, lbs (23.0+5%) Specific Impulse (272 min.)   | 24.3                                      | 24./<br>295             |
| •            | Start Time, msec (25 max) Shutdown Impulse, lb-sec (.260 max) * Oxidizer Valve Voltage, volts                     | 1796                                      |                         |
|              | Fuel Valve Voltage, volts Oxidizer Valve Current, amps  | 25.3<br>1650                              |                         |
| •            | Fuel Valve Current, amps<br>Electrical Power, watte   | 32.5                                      |                         |

Prepared by:

Chacked by:

Approximation | Approximation by:

Found 600-d-37 HEV 6-63 366

\* Ref: ECN NA-SE6-289R1

| COMPONENT NAME THRUST CHAIRER ASSEMBLY - 25#   | PART NO { MAC 52-52701-265   |
|--|--|
| NAME OF TEST DAT JUTY CYCLE TO 160 SECONDS   | — PART NO { NAA <u>208160-61</u><br>— TEST NO <u>203160-SHEET</u> OF   |
| Sequence Number 3 Pulse Number /   | Site Standard<br>Data Vecuum   |
| Firing Duration, sec  Accumulated Firing Time, sec  Data Slice Number  Time of Data Slice, sec  Environmental Pressure, psia  Environmental Temperature, P  Oxidizer Temperature, P  Fuel Temperature, P  Oxidizer Inlet Pressure, psia  Fuel Inlet Pressure, psia  Oxidizer Flowrate, lbs/sec  Fuel Flowrate, lbs/sec  Mixture Ratio, o/f (1.30+6%)  Thrust, lbs (23.0+5%)  | .687 21.8 2 .65 .016 0 .41 (vyc.chambar) 58 70 59 70 298.6 292 294.5 292 .0471 .0461 .0353 .0352 1.34 1.31 24.3 24.0 |
| Specific Impulse  Start Time, msec (25 max)  Shutdown Impulse, 1b-sec (.260 max)   | 295 296<br>-14<br>x)** .1718   |
| Oxidizer Valve Voltage, volts Fuel Valve Voltage, volts Oxidizer Valve Current, amps Fuel Valve Current, amps Electrical Power, watts  | 25.8<br>25.3<br>.636<br>.621<br>32.1   |
| * Ref: ECN NA-SE6-289R1  | A Jarmada da di ana Richa  |
| Prepared by s  Chacked for a C | Approvide ville sind fire  |
| TC4 000-8-37 RW 6-63 R-15019-2   | 367  |

COMPONENT NAME THRUST CHAMBER ASSETBLY - 25# PART NO. NAME OF TEST \_\_ DAT DUTY CYCLE TO 160 SECONDS TEST NO. 203160-SHEFT Sequence Number 4 Pulse llumber 2 26 Signal Width, msec 17.1 12.6 17.8 Start Time, msec (25 max.) 15.1 16.1 16,3 Environmental Pressure, psia 013 013 013 Environmental Temperature. F 70 20 70 Oxidizer Inlet Temperature, F 70 70 70 Fuel Inlet Temperature. F 70 70 70 Oxidizer Inlet Pressure, psia 292 292 292 Fuel Inlet Pressure, psia 292 292 292 Total Oxidizer Flow, 1bs 00093 Total Fuel Flow, 1bs 00077 Mean Mixture Ratio, o/f 1.246 1,206 Pulse Total Impulse, 1b-sec Mean Specific Impulse, sec Shutdown Impulse, 1b-sec (.260 max) \*\* 1583 1623 Cut-Off Time, msec\_ 13.3 12.4 12.9 Oxidizer Valve Voltage, volts 26 26 26 Fuel Valve Voltage, volta 26 26 Oxidizer Valve Current, emps 645 Fuel Valve Current, amps 639 639 639 Electrical Power, watts 33.4

\* Ref: ECN NA-SE6-289RL

| Prepared by: 12. Robinson | Checked by: | Protect 1 | Approved | To have by: |
|---------------------------|-------------|-----------|----------|-------------|
| FORM 608-8-37 NEW 6-63    | ~~~         |           |          | ·           |

| ie up les | T DAT DUTY CYCLE TO 160 SECONDS       | TEST NO. 20316 | O=SKEETOF.                              |
|-----------|---------------------------------------|----------------|---|
| •         | Sequence Number 5                     | Site           | Standard                                |
| •         | Pulse Number 3                        | Data           | Vacuum                                  |
| •         | Firing Duration, sec                  | .694           | : * * * * * * * * * * * * * * * * * * * |
|           | Accumulated Firing Time, sec          | 26.4           | + 2 ·                                   |
|           | Data Slice Number                     | 3              | •                                       |
|           | Time of Data Slice, sec               | .45            |   |
|           | Environmental Pressure, psia          | .013           | 0                                       |
| •         | Environmental Temperature, F          | 44 (VI         | He, chamber)                            |
|           | Oxidizer Temperature, OF              | 61             | 70                                      |
|           | Fuel Temperature, F                   | . 61           | 70                                      |
|           | Oxidizer Inlet Pressure, psia         | 296.5          | 292                                     |
| · . ·     | Fuel Inlet Pressure, psia             | 294.5          | 292                                     |
|           | Oxidizer Flowrate, lbs/sec            | 1479           | 1471                                    |
| •         | Fuel Flowrate, lbs/sec                | .0354          | .0353                                   |
|           | Mixture Ratio, o/f (1.30+6%)          | 1.35           | 1.34                                    |
| . ••      | Thrust, 1bs (23.0±5%)                 | 24.0           | 23.8                                    |
|           | Specific Impulse                      | 288            | 289                                     |
|           | Start Time, msec (25 max)             | 13             |   |
|           | Shutdown Impulse, 1b-sec (.260 max) * | 1687           | •                                       |
| . •       | Oxidizer Valve Voltage, volta         | 25.8           | eg af                                   |
|           | Fuel Valve Voltage, volts             | 25.4           | •                                       |
|           | Oxidizer Valve Current, amps          | 639_           |   |
|           | Fuel Valve Current, amps              | .621           |   |
|           | Electrical Power, watte               | 32.3           |   |
|           | *Ref: ECN NA-SE6-289RL                |                |   |

| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# PART NO. MAC 52-52701-265 |          |         |        |              |
|--|----------|---------|--------|--------------|
| NAME OF TEST DAT DUTY CYCLE TO 160 SECONDS TEST NO 208160-SHEET OF     |          |         |        |              |
| Sequence Number 6  |          | • •     |        |              |
| Pulse Number   | 2        | 16      | 26     |              |
| Signal Width, msec   | 22.9     | 23.2    | 21.2   | ·            |
| Start Time, msec (25 max.)   | 13.7     | 15.9    | 14.7   |              |
| Environmental Pressure, psia   | .013     | .013    | .013   |              |
| Environmental Temperature, OF  | 70       | 70      | 70     |              |
| Oxidizer Inlet Temperature, OF   | 70       | 70      | 70     |              |
| Fuel Inlet Temperature, oF   | 70       | 70      | 70     |              |
| Oxidizer Inlet Pressure, psia  | 292      | 292     | 292    |              |
| Fuel Inlet Pressure, psia  | 292      | 292     | 292    |              |
| Total Oxidizer Flow, 1bs   | .00118   | ,00/21  | .00107 |              |
| Total Fuel Flow, 1bs   | .00096   | 00101   | .00088 |              |
| Mean Mixture Ratio, o/f  | 1,232    | 1,207   | 1.216  |              |
| Pulse Total Impulse, 1b-sec  | 4415     | .4254   | .3733  |              |
| Mean Specific Impulse, sec   | 206.8    | 191.7   | 191.2  |              |
| Shutdown Impulse, lb-sec (.260 max) *                                  | .1760    | 1707    | 1724   | 1            |
| Cut-Off Time, msec   | 12.3     | 11.3    | 11.3   | ] .          |
| Oxidizer Valve Voltage, volts  | 26       | 26      | 26     | ] :          |
| Fuel Valve Voltage, volts  | 26       | 26      | 26     | ]            |
| Oxidizer Valve Current, amps   | .645     | .645    | .645   | 1            |
| Fuel Valve Current, amps   | ,639     | .639    | ,639   | ]            |
| Electrical Power, watts  | 33.4     | 33.4    | 33.4   |              |
| ** Ref: ECN NA-SE6-289RL   | •        | •       |        | <del>-</del> |
| Prepared by: Checked by: 7 //  | Appr     | old for | HAODA: |              |
| 1                                | <i>j</i> | WEVI.   | IN A   |              |

| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# P |             |                |       |
|--|-------------|----------------|-------|
| NAME OF TEST DAT DUTY CYCLE TO 160 SECOIDS     | TEST NO.200 | 160-SFEET_     | OF    |
| Sequence Number 7                              |             |                |       |
| Pulse Number                                   | 16          | 101            |       |
| Signal Width, msec                             | 34.9        | 37.2           |       |
| Start Time, msec (25 max.)                     | 14.6        | 12.7           |       |
| Environmental Pressure, psia                   | .013        | .013           |       |
| Environmental Temperature, F                   | 70          | 70             |       |
| Oxidizer Inlet Temperature, OF                 | 70          | 70             |       |
| Fuel Inlet Temperature, oF                     | 70          | 70             |       |
| Oxidizer Inlet Pressure, psia                  | 292         | 292            |       |
| Fuel Inlet Pressure, psia                      | 292         | 292            |       |
| Total Oxidizer Flow, 1bs                       | 00173       | .00181         |       |
| Total Fuel Flow, 1bs                           | 00139       | .00142         |       |
| Mean Mixture Ratio, o/f                        | 1.242       | 1.272          |       |
| Pulse Total Impulse, 1b-sec                    | .7103       | .7362          |       |
| Mean Specific Impulse, sec                     | 227.6       | 227.9          |       |
| Shutdown Impulse, 1b-sec (.260 max) *          | .1654       | .1464          |       |
| Cut-Off Time, msec                             | .11.3       | 11.3           |       |
| Oxidizer Valve Voltage, volts                  | 26          | 26             |       |
| Fuel Valve Voltage, volts                      | 2.6         | 26             |       |
| Oxidizer Valve Current, amps                   | .645        | .645           |       |
| Fuel Valve Current, amps                       | .639        | ,639           | •     |
| Electrical Power, watts                        | 33.4        | 33.4           | · ]   |
| *Ref: ECN NA-SE6-289RL                         |             |                | **    |
| Prepared by: Checked by:                       | Appr        | May the factor | 3-82: |
| FO.RH 608-8-37 NEW 6-63                        | <del></del> | 4              |       |

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COMPONENT NAME THRUST CHAIRER ASSEMBLY - 25# PART NO { MAC 52-52701-265 NAME OF TEST DAT DUTY CYCLE TO 160 SECONDS TEST NO 203160-SHEET OF

| Sequence Number 8                    | Site       | Standard    |
|--------------------------------------|------------|-------------|
| Pulse Number 3                       | Data       | Vacuum      |
| Firing Duration, sec                 | 1692       |             |
| Accumulated Firing Time, sec         | 35.7       |             |
| Data Slice Number                    | 4          | •           |
| Time of Data Slice, sec              | .65        |             |
| Environmental Pressure, psia         | .013       | 0           |
| Environmental Temperature, °F        | 49 (VA     | e, chumber) |
| Oxidizer Temperature, OF             | 63         | 70          |
| Fuel Temperature, OF                 | <u> 13</u> | 70          |
| Oxidizer Inlet Pressure, psia        | 294.4      | 292         |
| Fuel Inlet Pressure, psia            | 294.5      | 292         |
| Oxidizer Flowrate, lbs/sec           | .0476      | .0471       |
| Fuel Flowrate, lbs/sec               | .0359      | .0357       |
| Mixture Ratio, o/f (1.30+6%)         | 1.33       | 1.32        |
| Thrust, 1bs (23.0±5%)                | 24.3       | 24.2        |
| Specific Impulse                     | 291        | 292         |
| Start Time, msec (25 max)            | . 16       |             |
| Shutdown Impulse, lb-sec (.260 max)* | 1811       | •           |
| Oxidizer Valve Voltage, volts        | 25.8       | •           |
| Fuel Valve Voltage, volts            | 25.3       |             |
| Oxidizer Valve Current, amps         | 1639       |             |
| Fuel Valve Current, amps             | 1615       |             |
| Electrical Power, watts              | 32.0       |             |
|                                      |            |             |

\*Ref: ECN NA-SE6-289Rl

| Prepared by:               | Chocked by: | Approved | Let fird phe |
|----------------------------|-------------|----------|--------------|
| FORM 600-8-31 NEW 6-63 372 |             |          | R-15010_0    |

| Pulse Number  Signal Width, msec  Start Time, msec (25 max.)  Environmental Pressure, psia | 32.7  | iļ.    |   |
|--|-------|--------|---|
| Start Time, msec (25 max.)   |       |        | 1 |
| Start Time, msec (25 max.)   |       | 32.4   |   |
| Unversamental Programs nate  | 11.5  | 12.2   |   |
| Privite car Lieseme bara   | .0/3  | .013   |   |
| Environmental Temperature, or  | 70.   | 70     |   |
| Oxidizer Inlet Temperature, F  | 70    | .70    |   |
| Fuel Inlet Temperature, or   | 70    | 70     |   |
| Oxidizer Inlet Pressure, psia  | 292   | 292    |   |
| Fuel Inlet Pressure, psia  | 292   | 292    |   |
| Total Oxidizer Flow, 1bs .   | 00163 | .00158 |   |
| Total Fuel Flow, 1bs   | 00131 | 00/26  |   |
| Mean Mixture Ratio, o/f  | 1.244 | 1.252  |   |
| Pulse Total Impulse, 1b-sec  | 7191  | .6928  |   |
| Mean Specific Impulse, sec   | 244.3 | 243.8  |   |
| Shutdown Impulse, 1b-sec (.260 max)*   | ,2050 | 2072   |   |
| Cut-Off Time, msec   | 12.7  | 12.2   |   |
| Oxidizer Valve Voltage, volta  | 26    | 26     |   |
| Fuel Valve Voltage, volts  | 26    | 26     |   |
| Oxidizer Valve Current, amps   | 1645  | .645   |   |
| Fuel Valve Current, amps   | 1639  | 1639   | , |
| Electrical Power, watts  | 33.4  | 33.4   | , |
| * Ref: ECN NA-SE6-289Rl  | •     |        |   |

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#### ROCKETDYNE

# DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

| COMPONENT NAME THRUST CHAIRER ASSETBLY - 25# | 25# PART NO. NAA 208160 |        |        |
|--|-------------------------|--------|--------|
| NAME OF TEST DAT DUTY CYCLE TO 160 SECONDS   | TEST NO.20              | ~~~~~  |        |
| Sequence Number 10                           |                         |        |        |
| Pulse Number                                 | 4                       | 9      | 541    |
| Signal Width, msec                           | 58.7                    | 58.2   | 60.2   |
| Start Time, msec (25 max.)                   | 10.7                    | 10.9   | 11.3   |
| Environmental Pressure, psia                 | .013                    | ,013   | .013   |
| Environmental Temperature, oF                | 70                      | 70     | 20     |
| Oxidizer Inlet Temperature, OF               | 70                      | 70     | 20     |
| Fuel Inlet Temperature, F                    | 70                      | 70     | 70     |
| Oxidizer Inlet Pressure, psia                | 292                     | 292    | 292    |
| Fuel Inlet Pressure, psia                    | 292                     | 292    | 292    |
| Total Oxidizer Flow, 1bs                     | ,00286                  | ,00291 | ,00288 |
| Total Fuel Flow, 1bs                         | ,00220                  | ,00224 | ,00220 |
| Mean Mixture Ratio, o/f                      | 1.302                   | 1,297  | 1.3//  |
| Pulse Total Impulse, 1b-sec                  | 1.3941                  | 1.3749 | 1.3860 |
| Mean Specific Impulse, sec                   | 225,3                   | 266.7  | 272.6  |
| Shutdown Impulse, 1b-sec (.260 max)**        | .2/81                   | .2205  | 1981   |
| Cut-Off Time, msec                           | 12.5                    | 14.3   | 11.9   |
| Oxidizer Valve Voltage, volts                | 26                      | 26     | 26     |
| Fuel Valve Voltage, volts                    | 26                      | 26     | 26     |
| Oxidizer Valve Current, amps                 | .645                    | .645   | .645   |
| Fuel Valve Current, amps                     | .639                    | .439   | .639   |
| Electrical Power, watts                      | 33.4                    | 33.4   | 33.4   |
| **   |                         | -,     |        |

\*Ref: ECN NA-SE6-289RL

| Prepared by:           | Checked by: 1/ | Approved for PAN by: |
|------------------------|----------------|----------------------|
| W. Robinson            | Wit Kickle     | KIN KINDS            |
| FORM 600-8-37 NEW 6-63 | V              |                      |

| COMPONENT NAMETHRUST_CHANBER ASSEMBLY - 25#  NAME OF TESTDAT_DUTY_CYCLE_TO 160 SECONDS | _ PART NO. { MAI<br>_ TEST NO. <u>2031</u> | 52-52701-<br>A 208160<br>60-speet |     |
|--|--|-----------------------------------|-----|
| Sequence Number //_  |  |                                   |     |
| Pulse Humber   | 15   |                                   |     |
| Signal Width, msec   | 36.7                                       |                                   |     |
| Start Time, msec (25 max.)   | 12.6                                       |                                   |     |
| Environmental Pressure, psia   | .013                                       |                                   |     |
| Environmental Temperature, Or  | 70   |                                   |     |
| Oxidizer Inlet Temperature, P  | 70   |                                   |     |
| Fuel Inlet Temperature, F  | 70   |                                   |     |
| Oxidizer Inlet Pressure, psia  | 292  |                                   |     |
| Fuel Inlet Pressure, psia  | 292  |                                   | -   |
| Total Oxidizer Flow, 1bs   | .00186                                     |                                   |     |
| Total Fuel Flow, 1bs   | .00148                                     |                                   |     |
| Mean Mixture Ratio, o/f  | 1.251                                      |                                   |     |
| Pulse Total Impulse, 1b-sec  | 8362                                       |                                   |     |
| Mean Specific Impulse, sec   | 250.3                                      |                                   |     |
| Shutdown Impulse, 1b-sec (.260 max) *  | ,2410                                      |                                   |     |
| Cut-Off Time, msec   | .14.9                                      |                                   |     |
| Oxidizer Valve Voltage, volts  | 26   |                                   |     |
| Fuel Valve Voltage, volts  | 26   |                                   |     |
| Oxidizer Valve Current, amps   | .645                                       |                                   |     |
| Fuel Valve Current, amps .   | . 439                                      |                                   |     |
| Electrical Power, watts  | 33.4                                       |                                   |     |
| * Ref: ECN NA-SE6-289Rl .  | •  |                                   |     |
| Prepared by: Checked by:  M. Mohinson FORM 608-B-37 NEW 6-63                           | Apprô                                      | A Con Firm                        | bys |

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R-15019-2

| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# | PART NO. ( MAC 52-52701-265 NAA 208160-61 |
|--|---|
| NAME OF TEST DAT DITY CYCLE TO 160 SECONDS   | _TEST NO. 203760-51 ETOF                  |
|  |   |

| Sequence Number 15                     | Site   | Standard   |
|--|--------|------------|
| Pulse Number 4                         | Data   | Vacuum     |
| Firing Duration, sec                   | 1696   |            |
| Accumulated Firing Time, sec           | 78.1   | •          |
| Data Slice Number                      | _5     | •          |
| Time of Data Slice, sec                | _65_   |            |
| Environmental Pressure, psia           | .013   | 0          |
| Environmental Temperature, F           | 64 (VA | c.chamber) |
| Oxidizer Temperature, OF               | . 64   | 70         |
| Fuel Temperature, OF                   | 65     | 70         |
| Oxidizer Inlet Pressure, psia          | 294.4  | 292        |
| Fuel Inlet Pressure, psia              | 294.5  | 292        |
| Oxidizer Flowrate, lbs/sec             | 1974   | .0469      |
| Fuel Flowrate, lbs/sec                 | .0355. | .0353      |
| Mixture Ratio, o/f (1.30.6%)           | 1.34   | 1.33       |
| Thrust, 1bs (23.0+5%)                  | 23.8   | 23.7       |
| Specific Impulse                       | 287    | 288        |
| Start Time, msec (25 max)              | 18     |            |
| Shutdown Impulse, 1b-sec (.260 max) \$ | 1827   |            |
| Oxidizer Valve Voltage, volts          | 25.8   |            |
| Fuel Valve Voltage, volts              | 25.4   |            |
| Oxidizer Valve Current, amps           | .631   | •          |
| Fuel Valve Current, amps               | .609   |            |
| Electrical Power, watts                | 3/.8   |            |
|  |        |            |

\* Ref: ECN NA-SE6-289Rl

Prepared by:

Checked by:

Approved for MA by:

Checked by:

Checked by:

Checked by:

Checked by:

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Checked by:

Checked by:

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R-15019-2

| COMPONENT NAMETHRUST CHAMBER ASSETBLY - 25# NAME OF TESTDAT_DUTY_CYCLE TO 160 SECONDS | I NAA ZINIA    | ror    |
|---|----------------|--------|
| Sequence Number 17  |                |        |
| Pulse Number  | 8              |        |
| Signal Width, msec  | 58.6           |        |
| Start Time, msec (25 max.)  | 11.5           |        |
| Environmental Pressure, psia  | .013           |        |
| Environmental Temperature, OF   | 70             |        |
| Oxidizer Inlet Temperature, OF  | 70             |        |
| Fuel Inlet Temperature, or  | 70             |        |
| Oxidizer Inlet Pressure, psia   | 292            |        |
| Fuel Inlet Pressure, psia   | 292 .          |        |
| Total Oxidizer Flow, 1ba  | .00277         |        |
| Total Fuel Flow, lbs  | .00217         |        |
| Mean Mixture Ratio, o/f   | 1.276          |        |
| Pulse Total Impulse, 1b-sec   | 1.3471         |        |
| Mean Specific Impulse, sec  | 272.9          |        |
| Shutdown Impulse, lb-sec (.260 max) **  | ,2229          |        |
| Cut-Off Time, msec  | .15,9          |        |
| Oxidizer Valve Voltage, volta   | 76             |        |
| Fuel Valve Voltage, volts   | 26             |        |
| Oxidizer Valve Current, amps  | .645           |        |
| Fuel Valve Current, amps  | .639           |        |
| Electrical Power, watts   | 33.4           |        |
| * Ref: ECN NA-SE6-289RL   |                |        |
| Prepared by: Checked by: MA Park &  | Vabrahen tol N | AA by: |

R-15019-2

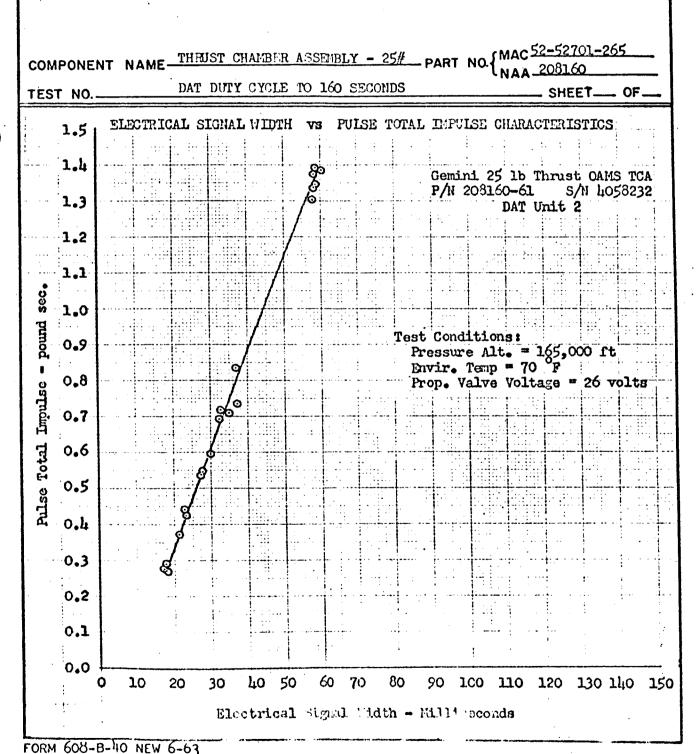
| COMPONENT NAME THRUST CHAIRFER ASSEMBLY - 25# P  | PART NO.                         | 52-52701-26<br>208160-61     | 35 |
|--|----------------------------------|------------------------------|----|
| NAME OF TEST DAT DUTY CYCLE TO 160 SECONDS   | EST NO. 203160                   | LIO)<br>ESKEET               | OF |
| Sequence Number 23 Pulse Number 5  | Site<br>Data                     | Standard<br>Vacuum           | •  |
| Firing Duration, sec  Accumulated Firing Time, sec  Data Slice Number  Time of Data Slice, sec  Environmental Pressure, psia | 123.3                            | 0                            | •  |
| Environmental Temperature, °F<br>Oxidizer Temperature, °F<br>Fuel Temperature, °F  | .013<br>                         | . ch n m b ev)<br>70<br>70   | •  |
| Oxidizer Inlet Pressure, psia Fuel Inlet Pressure, psia Oxidizer Flowrate, lbs/sec Fuel Flowrate, lbs/sec                    | 296.5<br>292.3<br>.0476<br>.0357 | 292<br>292<br>.0468<br>.0358 | •  |
| Mixture Ratio, o/f (1.30±6%) Thrust, 1bs (23.0±5%) Specific Impulse  | 1.33<br>24.0<br>288              | 1.31                         |    |
| Start Time, msec (25 max) Shutdown Impulse, lb-sec (.260 max) * Oxidizer Valve Voltage, volts Fuel Valve Voltage, volts      | 17<br>.2353<br>26.0<br>25.6      |                              |    |
| Oxidizer Valve Current, emps<br>Fuel Valve Current, emps<br>Electrical Power, watts  | . 622                            |                              |    |
| *Ref: ECN NA-SE6-289Rl   |                                  |                              |    |

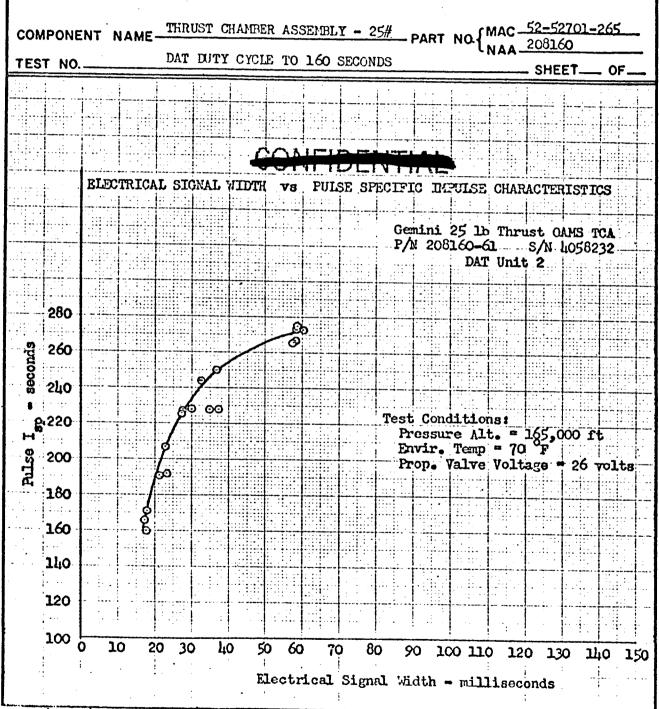
ONN 600-U- JT HEW 6-63 378

Prepared by:

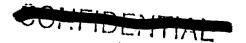
R-15019-2

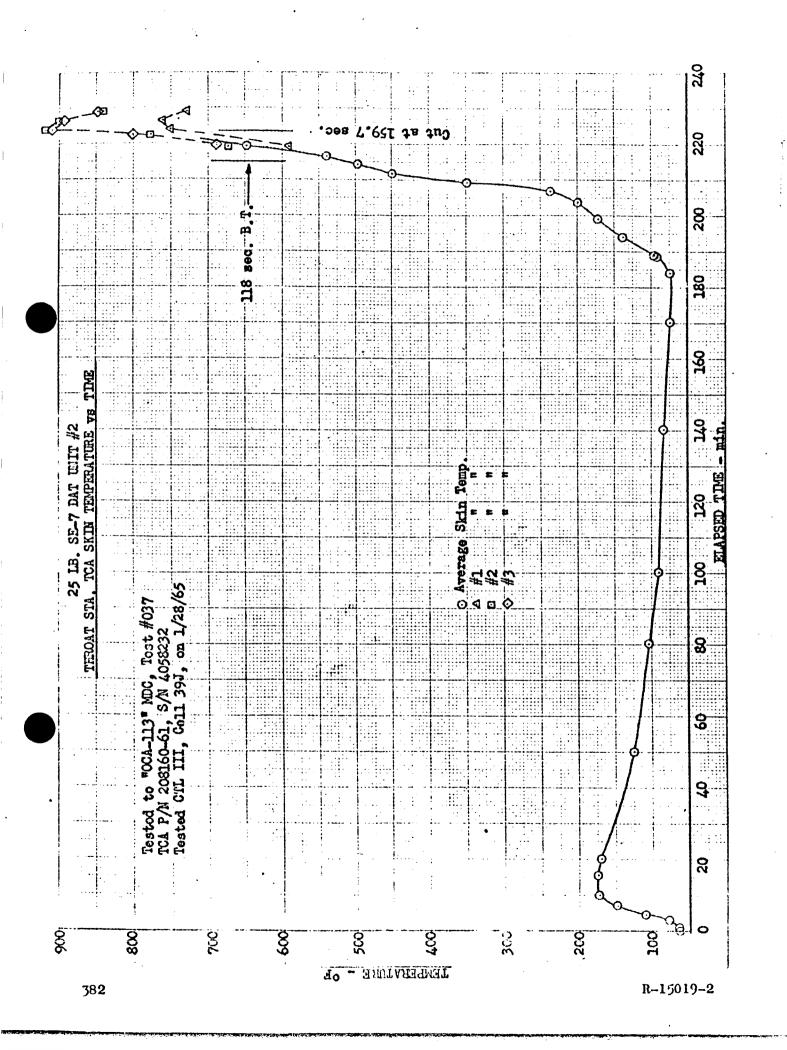
|  | ·                                     |                      |             |                         |       |   |  |
|--|---------------------------------------|----------------------|-------------|-------------------------|-------|---|--|
| COMP                                       | ONENT NAME _ THRUST CH                | AHBER ASSEIBLY - 25# | PART NO {   | IAC 52-5270             | 1-265 |   |  |
| NAME OF TEST DAT DUTY CYCLE TO 160 SECONDS |                                       |                      | TEST NO. 20 | TEST NO 208160-SHEET_OF |       |   |  |
| Sequence Number 25                         |                                       |                      |             |                         |       |   |  |
| Pu   | lse Number                            |                      | 4           | 7                       | ·     | 1 |  |
| Si   | nal Width, msec                       |                      | 57.9        | 58.1                    | •     | · |  |
| St   | art Time, msec (25 ma                 | x.)                  | 10.9        | 10.9                    |       |   |  |
| En   | vironmental Pressure, p               | sia                  | ,013        | ,013                    |       |   |  |
| En   | vironmental Temperature               | , ° <u>F</u>         | 70          | 70                      |       |   |  |
| Ox   | kidizer Inlet Temperature, °F         |                      | 70          | 70                      |       |   |  |
| Fu   | el Inlet Temperature, °               | <u> </u>             | 70          | 70                      |       |   |  |
| Ox   | idizer Inlet Pressure,                | psia                 | 292         | 292                     |       |   |  |
| · Fu                                       | el Inlet Pressure, psig               |                      | 292         | 292                     |       |   |  |
| To   | tal Oxidizer Flow, 1bs_               |                      | .00274      | .00276                  |       |   |  |
| To   | tal Fuel Flow, 1bs                    |                      | 1,00217     | .00215                  |       |   |  |
| Me   | an Mixture Ratio, o/f_                |                      | 1.262       | 1.280                   |       |   |  |
| Pu   | Pulse Total Impulse, 1b-sec           |                      | 1.3040      | 1.3394                  | ·     |   |  |
| Me   | Mean Specific Impulse, sec            |                      | 265.9       | 272.6                   |       |   |  |
| Sh   | Shutdown Impulse, 1b-sec (.260 max) # |                      |             | . 2185                  |       |   |  |
| Cu   | Cut-Off Time, msec                    |                      | 20,3        | 20.0                    |       |   |  |
| Ox   | Oxidizer Valve Voltage, volts         |                      | 26          | 26                      |       |   |  |
| Fu   | Fuel Valve Voltage, volts             |                      | 26          | 26                      |       |   |  |
| Ox   | Oxidizer Valve Current, amps          |                      | 1645        | .645                    |       |   |  |
| Fu   | Fuel Valve Current, amps              |                      |             | ,639                    |       |   |  |
| El   | Electrical Power, watts               |                      |             | 33.4                    |       |   |  |
| *Ref: ECN NA-SE6-289RI                     |                                       |                      |             |                         |       |   |  |
| Propared by: Checked by:                   |                                       |                      | / / Appr    | il, rollbyrg            | M by: |   |  |
| Work mon W. Michael Willed                 |                                       |                      |             | r ·                     |       |   |  |
| TORM 608-8-37 NEW 6-63                     |                                       |                      |             |                         |       |   |  |





FORM 608-B-40 NEW 6-63





#### A DIVISION OF NORTH AMERICAN AVIATION INC

#### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

|                  | THRUST CHAMBER ASSEMBLY-25# | ( MAC            | 52-52701-265 |
|------------------|-----------------------------|------------------|--------------|
| COMPONENT NAME _ | TIMOST OIMESER ROSEPELI-ZOF | PART NO.         | 208160-61    |
| NAME OF TEST     | LUTY CYCLE TO 160 SECONDS   | _ TEST NO.208160 | SHEETOF      |

8 February, 1965

**Teviation Request:** 

The Hot-Fire Test data (paragraphs 7.2.3 and 7.2.4) will be completed when data is available. Proceed with Weight Determination (paragraphs 6.6 and 7.2.4.3) for TCA P/N 208160-61 S/N 4058232.

All other testing has been completed on this TCA.

R.Cole

Gemini DAT-RAT Unit

James D. Navrogedis

MAC Engineering

2-8-15

FORM 608-B-37 NEW 6-63

| COMPONENT NAM  |   |               |
|----------------|---|---------------|
| NAME OF TEST   | DAT DUTY CYCLE TO 160 SECONDS TEST NO 208160 SHE  | ET 329 0F 380 |
| 7.2.4.3        | Weight Determination Test (reference paragraph 6.6)   |               |
|                | All protective closures were removed from the TCA.  YES or No)  The TCA dry weight was 2.98 pounds.  (Record to the nearest one-hundredth pound). | •             |
|                | Inspection Remarks  | •             |
|                | NONE 2-9-65   |               |
|                |   | ,             |
| •              |   | •             |
| •              |   |               |
|                |   | ·             |
|                |   |               |
|                |   | •             |
|                |   |               |
| PREPARED BY, D | DATE PERFORMED BY DATE WITNESSED FOR MAA DATE CERTIFIED FOR M   |               |
| E. Adams 1/10/ |   | (224)         |

2-9-65

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FORM 608-8-39 HEW 0-63

#### ROCKETDYNE A DIVISION OF NORTH AMERICAN AVIATION, INC.

IL 5388-6158

INTERNAL LETTER

North American Aviation, Inc.

DATE

5 April 1965

TO

Those Concerned

FROM

Gemini DAT Unit

Address

Address

D/896-388

SUBJECT

Deviation to DAT Specification 208160-401

REFERENCE

OFR 12924R and 32656R

Failure analysis on 25 lb OMSGemini DAT TCA P/N 208160-61, S/N 4058232, shall satisfy the DAT specification requirements of disassembly and inspection.

During the failure analysis, all disassembly and inspection requirements of the DAT specification shall be accomplished in order to eliminate the added operation of returning the hardware from failure analysis to DAT.

Gemini DAT Unit

Approved:

R. L. Free MAC Engineering

R--15019-2

|   | COMPONENT NAME         | THRUST CHAMBER ASSEMBLY - 25# PART NO. MAC 52-52701-265  |
|---|------------------------|--|
|   |                        | (NAA <u>208160-61</u>  |
|   | NAME OF TEST_DIS       | SASSETBLY AND INSPECTION TEST NO. 208160- SHEET 330F 380   |
| ) | Reference:             | MAC SCD 52-52701, Revision ", Paragraph 6.2.3.20   |
| , | 7.2.5                  | Disassembly and Inspection   |
|   | 7.2.5.1                | Test Procedure   |
|   | 7.2.5.1.1              | Prior to sectioning the TCA perform a visual inspection and record the post test condition of the TCA.   |
|   | .7.2.5.1.2             | Cut the propellant valve mounting bracket and propellant valve feed tubes from the TCA injector face along line A, B as shown in Figure 11. All cutting shall be done by saw.  |
|   | 7.2.5.1.3              | Separate the propellant valves from the mounting bracket.  |
|   | 7.2.5.1.4              | Section the TCA by cutting along line C-D-E as depicted in Figure 11.  |
|   | 7.2.5.1.5              | Perform visual inspection of all detailed parts for evidence of damage, distortion, fluid incompatability, corrosion, broken parts and impending failure.  |
|   | 7.2.5.1.6              | After test completion identify the sectioned TCA and detailed parts and package and store for reference (except for propellant valves).  |
| ) | 7.2.5.1.7              | Machine, on the oxidizer propellant valve, the seat assembly to spacer weld to loosen the seat. Only the minimum amount of material to accomplish this shall be removed. The seat assembly P/N 407664 shall not be removed at this time. |
|   | 7.2.5.1.8              | Machine the filter assembly to solenoid weld to loosen the filter. Only the minimum amount of material to accomplish this shall be removed. The filter assembly P/N NA5-28097-17 shall not be removed at this time.                      |
|   | PREPARED BY:           | DATE APPROVED FOR NAA: DATE APPROVED FOR MCDONNELL: DATE   |
|   | R. Cole<br>CHECKED BY: | DATE MINIO   |
|   |                        | DATE / FWICE 11-30-64  |
| I | FORM 608-B-38 NEW      | 6-63   |

| COMPONENT NAME | THRUST CHAMBER ASSEMBLY - 25# PART NO. \[ \begin{align*} MAC \ \ 52-52701-265 \\ NAA \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ |
|----------------|--|
| NAME OF TEST   | DISASSFIBLY AND INSPECTION TEST NO. 208160_SHEET 30. 6F 380  |
| 7.2.5.1.9      | Remove, bag and identify the seat assembly.  |
| 7.2.5.1.10     | Remove, bag and identify the armature P/N 407569.  |
| 7.2.5.1.11     | Remove, bag and identify the spring P/N 406806.  |
| 7.2.5.1.12     | Remove, bag and identify the filter assembly.  |
| 7.2.5.1.13     | Bag and identify the solenoid assembly.  |
| 7.2.5.1.14     | Repeat 7.2.5.1.7 thru 7.2.5.1.13 for the fuel propellant valve   |
|                | NOTE: Only authorized personnel shall have access to stored DAT hardware.  |

| PREPARED BY: | DATE             | APPROVED FOR NAA: | DATE  | APPROVED FOR MCDONNELL: |  |
|--------------|------------------|-------------------|-------|-------------------------|--|
| R. Cole      |                  | Pul.              |       |                         |  |
| CHECKED BY:  | DATE<br>11-30-64 | Klowle.           | 30-61 |                         |  |

FORM 608-B-38 NEW 6-63

Rev. C/D 77-1-84

R-15019-2

| COMPONENT NA                            | THRUST CHAMBER ASSEMBLY - 25#  PART NO  MAC 52-52701-265  NAA 208160-61  TEST NO 208160-15HEET 331 OF 380   |
|---|---|
| 7.2.5.2                                 | Post Test Inspection Data - TCA #2  |
| 7.2.5.2.1                               | Component Identification  |
| •                                       | Component Name TCA  |
|   | McDonnell Part No. <u>52-5270</u> 1-265   |
|   | Rocketdyne Part No. 208/60-6/   |
|   | Component Serial No. 4058232  |
| 7.2.5.2.2                               | Preliminary Inspection (Reference paragraph 7.2.5.1.1)  |
| 0<br>905<br>C                           | The TCA was visually inspected prior to sectioning and the TCA condition was as follows:    DOWNSTREAM OF THEORY   LET LINES FROM THEORY INCERT   |
| 7.2.5.2.3                               | Disassembly and Inspection (Reference paragraph 7.2.5.1.3)  The TCA was sectioned along line C-D-E and visually inspected. The results of the inspection were as follows: FBLATIVE SEPARATIONS ON CHAMBER SECHENT APPROXICATION NOTATION SECTION OF AMBRICATIONS OF THE CATIONS OF THE TOTAL INSERT.  THECAT INSERT IN 3 PIECES DUE TO THECAT INSERT.  PRING CRUCKED BELONG SECTIONING SIESVE HEAVILY |
|   | CHARRED & CHIPPED AT MEAN MENT TO THEORY. NOZZLE HAS SGPARATIONS STECS.   |
| PREPARED BY 7-10 E. Adams FORM 608-B-39 | OUTE PERFORMED DY DATE WITNESSED FOR NAA DATE CERTIFIED FOR MCDOWNELL DATE  - Sichop  - 5-5-65  VERBURED DY USAF  DATE  NEW 6-63  |

| •              |   |
|----------------|---|
| COMPONENT NAME | THRUST CHAMBER ASSEMBLY - 25# PART NO MAC 52-52701-265  |
| NAME OF TEST   | DISASSEMBLY AND INSPECTION TEST NO 203160_ SHEET 331 0F380.   |
| 7.2.5.2.4      | Disassembly of Propellant Valves (Reference Paragraphs 7.2.5.1.7 thru 7.2.5.1.13 .)                                   |
|                | The propollant valves were disassembled and all parts called for were bagged and identified / (yes or no).            |
| •              |   |
|                |   |
| •              |   |
|                |   |
| •              |   |
| •              |   |
|                |   |
|                |   |
| PREPARED DY 02 | THE PENTONIND DY CAME WITHERSED FOR HAA DATE CHITHERD FOR MODONNELL DATE  ON THE PENTONIND DY USAF DATE  15.7-65 DATE |

· FORM 608-8-39 NEW 6-63

Rov. C. D. Mara : Data 12-1-14

|     | DES | SIGN | APPR  | OVAL | TEST | OF | COMPONEN | TS     |
|-----|-----|------|-------|------|------|----|----------|--------|
| FOR | THE | ORB  | IT AT | TITU | DE A | ND | MANEUVER | SYSTEM |

| COMPONENT NAME               | · <del></del>           | T CHAMBER<br>ENT AND S |                                       |                        | PART NO           | (NAA _    | 52-52701-<br>208160-61<br>401<br>SHEET 332 |               |
|------------------------------|-------------------------|------------------------|---------------------------------------|------------------------|-------------------|-----------|--|---------------|
|                              |                         |                        |                                       |                        |                   |           |  | )r <u>200</u> |
| Reference:                   | MAC SCD                 | 52-52701,              | Revision                              | F, Figur               | e 12.             |           | •  | •             |
| 7.3                          | Thrust C                | hamber As              | sembly No                             | . 3                    |                   |           |  | •             |
|                              | This subperforme        | section sed on Thru    | pecifies<br>st Chambe                 | the tests<br>r Assembl | which<br>Ly No. 3 | are to b  |  |               |
|                              |                         |                        |                                       |                        |                   | •         |  |               |
|                              | •                       | •                      |                                       |                        |                   |           |  | •             |
|                              |                         |                        |                                       | •                      |                   | •         |  |               |
|                              |                         | •                      | •                                     | •                      |                   |           |  | • ,           |
| · .                          |                         | •                      | · · · · · · · · · · · · · · · · · · · | .•                     |                   |           | •  |               |
|                              | • •                     |                        |                                       | · ·                    |                   |           |  |               |
|                              |                         | •                      |                                       |                        |                   |           |  |               |
|                              |                         |                        |                                       | •                      | •                 |           | •  |               |
|                              |                         |                        |                                       | •                      |                   |           |  |               |
|                              |                         |                        |                                       |                        |                   |           |  |               |
| PREPARED BY:                 | DATE                    | AFPROVED F             | OR NAA:                               | DATE                   | APPITOV.          | O FCR McD | DNNELL:                                    | BATI          |
| E Adams Chacked BY: 21/1/2de | DATE<br>1/10/64<br>DATE | 11.40                  | E. 10 4                               | 1-13-64                |                   |           | 3-   |               |

| COMPONENT NAME                     | DDE TEST INSPECTION  |               |
|------------------------------------|--|---------------|
| Reference:                         | MAC SCD 52-52701, Revision F, paragraph 6.2.2.1  |               |
| 7.3.1                              | Pre-Test Inspection - TCA #3   |               |
| 7.3.1.1                            | Test Procedure   |               |
| 7.3.1.1.1                          | Verify that the TCA is of the proper configuration and hat passed the Acceptance Test of Rocketdyne Specification RAO220-354. Only the TCA's that comply with the above requirement shall be accepted for DAT. | .8            |
| 7.3.1.1.2                          | Record the Rocketdyne Part Number and Serial Number of the TCA.  | •             |
| 7.3.1.1.3                          | Record the Rocketdyne Part Number and Serial Number of the oxidizer propellant valve.  | 16            |
| 7.3.1.1.4                          | Record the Rocketdyne Part Number and Serial Number of the fuel propellant valve.  | ıe            |
| 7.3.1.1.5                          | Record the McDonnell Part Number of the TCA.   |               |
| 7.3.1.1.6                          | Inspect the TCA for visual evidence of damage or deterior Comment on all visual defects.   | ation.        |
| 7.3.1.1.7                          | Braze propellant valve inlet adapters to the fuel and oxidizer inlet tube stubs as defined in Rocketdyne Process Specification RAO607-009.   | <b>&gt;\$</b> |
| 7.3.1.1.8                          | Perform Weight Determination of paragraph 6.6.   |               |
|                                    |  |               |
| PREPARED BY: E. Adams CH.S.C.O.BY: | DATE APPROVED FOR NAA: DATE APPROVED FOR MCDONNELL:  OF 3.64  OATE  S-3.64  DATE   | DATE          |

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|                  |  | Į.            |
|------------------|--|---------------|
| COMPONENT NAM    | THRUST CHAMBER ASSEMBLY - 25# PART NO.   MAC   208160-61   |               |
| NAME OF TEST     | PRE-TEST INSPECTION TEST NO 203160-5HEET 3340F   | 380           |
| TARING OF TEST   | TEST NO ZOOTOO SHEET ZANG  |               |
| 7.3.1.2          | Test Data - TCA #3   |               |
| 7.3.1.2.1        | Component Identification Oxidizer Fuel   | , .           |
| •                | Component Name TCA Valve Valve   | Ī             |
| •                | McDonnell Part No. 52-52701-265  | -             |
| •                | Rocketdyne Part No. 208160-61 40 7559 5173 (215)   |               |
|                  | Component Serial No. 4057532 4057735 4055173   | •             |
| 7.3.1.2.2        | Inspection (reference paragraph 7.3.1.1)   | _,            |
| 7.3.1.2.2.1      | The TCA was inspected and found to be of the proper configuration and has passed the Acceptance Tests of RA0220-354. YES (yes or no) |               |
| 7.3.1.2.2.2      | Propellant Valve inlet adapters were installed on the propellant valves per paragraph 7.3.1.1.7 <u>VES</u> (yes or no)               | iv A          |
| 7.3.1.2.2.3      | Inspection Remarks   |               |
|                  | PROPELLANT VALVE INLET ANAPTERS  |               |
| •                | WERE INSTALLED PER RADGOT-009  |               |
|                  | INFORMATION OULY 10-6-64 (ATA)   |               |
| ~~~ <del>~</del> |  |               |
|                  |  |               |
|                  |  |               |
|                  | ATE PERFORMED BY DATE WITNESSED FOR NAM DATE CENTIFIED FOR MEDONINELL  | CHE           |
| E. Adams 7-16    | ATE PERFORMED BY DATE WITNESSED FOR NAA DATE CENTIFIED FOR MEDDINELL WHITE DY POCK STEMATE CONTINUED BY USAF                         | 195<br>076 74 |
| ORM 608-B-39 NEW | W 6-63   |               |
| •                |  |               |

| COMPONENT NAME | THRUST CHAMBER ASSEMBLY - 25# PART NO \( \begin{array}{llllllllllllllllllllllllllllllllllll                 |
|----------------|---|
| NAME OF TEST   | PRE-IEST TROTBOTTON 1EST NO. ZUMENT SHEET 222701 222  |
| 7.3.1.2.3      | Weight Determination Test Data (reference paragraph 6.6) All protective closures were removed from the TCA. |
|                | YES (Yes or No)   |
|                | The TCA dry weight was 3,12 pounds. (Record to the nearest one-hundredth pound).                            |
|                | Inspection Remarks  |
| •              |   |
|                |   |
|                |   |
| ·              |   |
|                |   |
|                |   |
| . •            |   |
|                |   |
|                |   |
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|                |   |
|                | ATE PERFORMED BY DATE WITNESSED FOR NAA DATE CERTIFIED FOR MEDONINGLA                                       |
| E. Adams       | 4 2. Baje 10-7-64 Rolling 11. 14 18-17-60   |
| 1              |   |

FORM 608-8-39 HE' 1 6-63

| COMPONENT NAME           | THRUST CHAMBER ASSEMBLY - 25# PART NO. { MAC 52-52701-265 NAA 203160-61   |
|--------------------------|---|
| NAME OF TEST             | DAT DUTY CYCLE TO 118 SECONDS TEST NO. 203160-601 3350F 380   |
| References               | MAC SCD 52-52701, Revision F, paragraph 6.3.1.3.2.2   |
| 7.3.2                    | DAT_Duty Cycle to 118 Seconds - TCA #3  |
| 7.3.2.1                  | Test Procedure  |
| 7.3.2.1.1                | Perform fuel and exidizer propellant valve orifice removal per paragraph 6.9.   |
| E (4)                    | Install fuel and exidizer propellant valve orifice adapter (99-105728) in the facility propellant feed system (See Figure 6).   |
| 7.3.2.1.3                | Install fuel and exidizer valve metering orifice and retaining ring in the facility mounted orifice adapter.  |
| 7.3.2.1.4                | Adjust instrumentation ranges per Table I and Note 6.   |
| 7.3.2.1.5                | Prform Cape Cycle Firing Test per paragraph 6.7.  |
| 7.3.2.1.5.1              | links a ons-second firing followed by another ons-second firing five minutes later.   |
|                          | thit ton minutes and make a one-second firing followed by another one-second firing five minutes later.   |
| 7.3.2.1.5.3              | Repeat paragraph 7.3.2.1.5.2.   |
|                          | Wait for TCA skin temperature to return to ambient temperature (70 ±207). Perform DNT Duty Cycle Firing Test per paragraph 6.7, and Table II. The TCA shall demonstrate opecification performance for a minimum accumulated firing time of 118 seconds. |
|                          | Maintain pressure altitude and monitor TCA exterior wall temperature until peak temperature is reached. The maximum allowable temperature shall not exceed 650 F.   |
| PREPARED EY:  R. Colo 9- | DATE APPROVED FOR MAA: DATE APPROVED FOR MODORIGELL: DATE   |
| CHICKED DY:              | Elias (III)   |
| FORM 600-8-30 NE         |   |

| •                |  |
|------------------|--|
| COMPONENT NAME _ | THRUST CHAMBER ASSEMBLY - 25# PART NO. { MAC 52-52701-265 208160-61  |
|                  | DAT DUTY CYCLE TO 118 SECONDS TEXT NO 203160-61  |
| name of test     | DAT DUTY CYCLE TO 118 SECONDS TEST NO. 203160-X01 336.1 380  |
| •                | EOTE: Do not reduce altitude or remove the TCA from the test stand. Perform the procedures of paragraph 7.3.3.1.1 thru 7.3.3.1.3 during TCA temperature scakout period of 20 ±5 minutes. Within 5 minutes after peak temperature is reached complete the procedures of paragraphs 7.3.3.1.4 thru 7.3.3.1.10. |
| 7.3.2.1.8        | Reduce data per SEM 4388-4040.   |
| 7.3.2.1.8.1      | The results of significant data shall include but not be limited to the following:   |
| 7.3.2.1.8.1.1    | Graphical presentation of temperature versus time for all TCA thermocouple locations including soakout period.   |
| 7.3.2.1.8.1.2    | Graphical presentation of total impulse versus signal width.   |
| 7.3.2.1.8.1.3    | Graphical presentation of mean specific impulse versus signal width.   |
| 7.3.2.1.9        | Perform weight determination per paragraph 6.6.  |

|                 | ····       |                                       |  |                                     |  |
|-----------------|------------|---------------------------------------|--|-------------------------------------|--|
| PREPARED BY:    | DÇIE       | APPROVED FOR MAA:                     | DATE AP  | PARAMED FOR MODORES                 | TATE   |
| E. Adams        | 10-9-64    |                                       |  |                                     | UNIC   |
| CHECKED BY:     | O. IE      | 1150                                  | 12 -01   |                                     |  |
| Reolo           | 10-9-11    | 13 VOCCE                              | 10-9-68  |                                     |  |
| Rame (all a all | 11711 6 60 | · · · · · · · · · · · · · · · · · · · | and the same of th | · TARRESTE THE STANDARD CO. L. LAND | The second secon |

FORM 608-2-38 NEW 6-63

|                  | THRUST CHAMBER ASSEMBLY - 25# PART NO MAC 208160-61   |
|------------------|---|
| COMPONENT NAME   | AT DUTY CYCLE TO 110 SECONDS  |
| NAME OF TEST     | TEST NO 203160-SHEET 33707 380  |
| 7.3.2.2          | Tost Data - TCA #3  |
| 7.3.2.2.1        | Component Identification  |
| • .• •           | Component Hame SETTCH 25#   |
| •                | HcDonnoll Part No. 52-52701-265   |
| *                | Rocketdyne Part No. 20810-61  |
| •                | Component Serial No. 4057537  |
|                  | Accumulated Acceptance Test Firing Time, seconds 60500  |
| •                | Pro-Test  |
|                  | Throat Diameter, inches (Average of four measurements)  |
|                  | Hossle Exit Diameter, inches  |
| 7.3.2.2.2        | Propollant Samples  |
| · .•             | Mitrogen Monomethyl Totroxide Hydrasine   |
|                  | Sample Date 11-2-64   |
|                  | Sample Batch Number   |
| <br>!            | Sample Temperature, P 60° 77°   |
| •                | Sample Specific Gravity 1.46/ 873   |
|                  | Hot Mil Spoo. Requirements (Yes or No) 1/65 465   |
| E. Adams .       | CITE PERFORMED ON CARE WHITESCED FOR THAT CAME CENTIFIED FOR CHOOMELL DATE  OF LET WHOLE VID TO BY USE 1/16-CLAIR  OF LET WHOLE VID TO BY USE 1/16-CLAIR  OF LET WHO WE WANTED FOR CHAIRE  OF LET WHO WE WANTED FOR CHAIRE  OF LET WHO WAS A PROPERTY OF THE CONTROLLY OF THE CHAIRE  OF LET WHO WAS A PROPERTY OF THE CHAIRE OF THE CHAIRE  OF LET WHO WAS A PROPERTY OF THE CHAIRE OF THE |
| FOILT LUSSIES NO | W 6-62  |

|  |                    |             | •                    |                         |
|--|--------------------|-------------|----------------------|-------------------------|
| COMPONENT NAM  | THRUST CHAMBER A   | SSEABLY -   |                      | 203760.67               |
| NAME OF TEST   | DUTY CYCII; TO 118 | SECONDS     | lΝΔ                  | 160 160 SHEET 3380F3 20 |
| Activities and the second sections of the second section of the section of the sectio |                    |             |                      |                         |
| 7.3.2.2.3  | Cape Cycle Test    | (referen    | ce paragraph 7.3.2   | <b>ユ)</b>               |
|  | Test Cell Location |             | etl-3                |                         |
|  | Test Cell Number   |             | 39-1                 | •                       |
|  | Test Number        | •           | 135                  |                         |
| •  | Test Date          | ••          | 11-3-64              |                         |
| •  |                    |             |                      |                         |
|  | •                  | ·           | Pulse Duration (sec) | Pulses, (minutes)       |
|  |                    | (S)         | (1.000 ±.020 sec)    | ·                       |
| •  | 1st Pulse          |             | .989                 | (5)                     |
|  | 2nd Pulse          |             | .987                 | 10 (10)                 |
|  | 3rd Pulse          |             |                      | _5_(5)                  |
|  | 4th Pulse          | •           | 986_                 |                         |
| .•   | 5th Pulse          |             | 986                  | _5_(5)                  |
| ·  | 6th Pulse          | ·           | _ 986                |                         |
|  | Accumulated Firing | Time, sec   | onds <u>5,92</u>     |                         |
|  |                    |             |                      |                         |
|  |                    |             |                      |                         |
|  |                    |             |                      | •                       |
| PREPARED BY  |                    | TE WITHESSE | 11/1                 | FIED-EDS MODONNELL DATE |
| R. Colo  | 11/3/64            | Ayis        | lily (3) VE          | SEQUEY USAF CATE        |
| FORM 608-8-20 N  |                    |             |                      |                         |

| •   |   |
|---|---|
| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 254                            | PART NO. (MAC 52-52701- 265   |
| NAME OF TEST DAT DUTY CYCLE TO 118 SECONS                               | TEST NO:200160 SHEET332 OF 380  |
| TOTAL OF TEST   | LIEST RUTAL TOLL SAZE 133107 JUNE   |
| 7.3.2.2.3 Duty Cycle Test ( reference paragram                          | oph 73.2.1 )  |
| Test Cell Location CTA-3 (A)  | 5)  |
| Test Cell lumber 37-5 (AND  |   |
| Test Number 126 9   |   |
|   | ም<br>(ች)  |
| Test Date   |   |
| The fuel and oxidizor propellant  | Alva orifices were revoved from   |
| the TCA per paragraph 6.9. VES  | ( yes or no )   |
| . The fuel and exidizer propellant v installed in the facility feed sys | ralve orifice adapters were ten. MS ( yes or no )   |
| The fuel and exiding propellant v                                       | alvo metering orifices were   |
| Trocurred in any regarded recorded                                      | erifico: edaptero. /ES (9) ( yes or no  |
|   |   |
|   |   |
|   |   |
|   |   |
|   |   |
|   | •   |
|   |   |
|   |   |
| PREPARED DY CATE PAULACINED CY CATE WITHER LED FO                       | THE CATE CENTIFIED FOR MCDONIGELL , DAT   |
| B. Adams 9-15-64 E. S. Hilben S. Y Kill                                 | 14 D. Marro-2 12/19/  |
| B. Adams 9-15-64 E. S. Hilben S.y Kille<br>11/1/64                      | 12 14 14  |
| FO.01 603-0-39 NEW 6-63   | and the second second section of the second |

| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25#                                    | _ PART NO. ${M \choose N}$ | ac <u>52-527</u> (<br>aa <u>208</u> 16( | 01-265<br>O |
|---|----------------------------|---|-------------|
| NAME OF TEST DAT DUTY CYCLE TO 118 SECONDS                                      | _ TEST NO.200              | 160-SFEE                                | TOF         |
| Sequence Number /   |                            |   |             |
| Pulse Number  | 3                          | . 16                                    | 24          |
| Signal Width, msec  | 36.3                       | 37./                                    | 37.0        |
| Start Time, msec (25 max.)  | 10.1                       | 10.3                                    | 8.8         |
| Environmental Pressure, psia  | ,022                       | ,022                                    | 1022        |
| Environmental Temperature, OF   | 70                         | 70                                      | 70          |
| Oxidizer Inlet Temperature, OF  | 70                         | 70                                      | 70          |
| Fuel Inlet Temperature, or  | 70                         | 70                                      | 70          |
| Oxidizer Inlet Pressure, psia   | 292                        | 292                                     | 292         |
| Fuel Inlet Pressure, psia   | 292                        | 292                                     | 292         |
| Total Oxidizer Flow, 1bs  | *                          | *                                       | *           |
| Total Fuel Flow, lbs  | *                          | *                                       | *           |
| Mean Mixture Ratio, o/f   | * *                        | *                                       | *           |
| Pulse Total Impulse, 1b-sec   | . 8365                     | .8517                                   | 8738        |
| Mean Specific Impulse, sec  | *                          | *                                       | *           |
| Shutdown Impulse, 1b-sec (.260 max)   | .1616                      | 1320                                    | 1504        |
| Cut-Off Time, msec  | .10.9                      | 10,0                                    | 10.2        |
| Oxidizer Valve Voltage, volts   | 26                         | 26                                      | 26          |
| Fuel Valve Voltage, volts   | 26                         | 26                                      | 26          |
| Oxidizer Valve Current, amps  | 459                        | 1659                                    | 659         |
| Fuel Valve Current, amps  | 1/242                      | 642                                     | 642         |
| Electrical Power, watts   | 33.8                       | 33.8                                    | 33.8        |
| <pre>% Flows Unreadable - Instrumentation Proble %* Ref: ECN NA-SE6-289R1</pre> | ems                        |   | •           |
| Propared by: Chooked by Mchile  | Ap; r                      | ) X W                                   | E by:       |
| FOR. 1 608-8-37 NEV 6-63  | }                          | <del>-</del>                            |             |

| COMPONENT NAME THE | UST CHAIBER ASSEMBLY - 25# P. Y CYCLE TO 118 SECONDS T | ART NO { MAC_<br>NAA_<br>EST NO 203760 | 52-52701-265<br>208160-61<br>-SF-EETOF |
|--------------------|--|--|--|
| Sequenc<br>Pulse N | tumber /   | Site<br>Data                           | Standard<br>Vacuum                     |
| Firing             | Duration, sec  | 4.2                                    |  |
| Accumul            | ated Firing Time, sec                                  | 21.0                                   |  |
| · Data Sl          | ice Number   |  | •                                      |
| Time of            | Data Slice, sec  | 4.0                                    |  |
| Environ            | mental Pressure, psia                                  | .022                                   | 0                                      |
|                    | mental Temperature, °F                                 | 65 (VAC                                | e.chamber)                             |
|                    | r Temperature, <sup>O</sup> F                          | 65                                     | 70                                     |
| Fuel Te            | mperature, °F  | 45                                     | 70                                     |
| Oxidize            | r Inlet Pressure, psia                                 | 285.4                                  | 292                                    |
| Fuel In            | let Pressure, psia                                     | 294.7                                  | <b>292</b> ·                           |
| Oxidize            | r Flowrate, lbs/sec                                    | .0455                                  | ,0461                                  |
| ' Fuel F1          | owrate, lbs/sec  | 1336                                   | .0332                                  |
| Mixture            | Ratio, o/f (1.30±6%)                                   | 1.35                                   | 1.39                                   |
| Thrust,            | lbs (23.0 <u>+</u> 5%)                                 | 22.4                                   | 22.6                                   |
| Specifi            | c Impulse (272 min.)                                   | 784                                    | 285                                    |
| Start T            | lime, msec (25 max)                                    | /3                                     | •                                      |
| Shutdow            | m Impulse, 1b-sec (.260 max) **                        | 1774                                   |  |
| Oxidize            | r Valve Voltage, volts                                 | 29.1                                   |  |
| Fuel Va            | ilve Voltage, volts                                    | 28.2                                   |  |
| Oxidize            | r Valve Current, amps                                  | .700                                   |  |
| Fuel Va            | dve Current, emps                                      | 629                                    |  |
| Electri            | cal Power, watts                                       | 39.5                                   |  |
| *                  | Ref: ECN NA-SE6-289Rl                                  |  |  |

12-15019-2

Prepared by:

| ME OF TEST | DAT DUTY CYCLE TO 118 SECONDS       | TEST I | NO. 20336    | 0-SK≥ETOF_         |
|------------|-------------------------------------|--------|--------------|--------------------|
| •          | Sequence Number 3 Pulse Number /    |        | Site<br>Data | Standard<br>Vacuum |
|            | Firing Duration, sec                |        | 690          | •                  |
| ,          | Accumulated Firing Time, sec        |        | 22           |                    |
|            | Data Slice Number                   | ****   | 2            | •                  |
|            | Time of Data Slice, sec             |        | 65           |                    |
|            | Environmental Pressure, psia        | -4-    | 022          | 0                  |
|            | Environmental Temperature, °F       |        | 45 (V)       | ye.chamber)        |
|            | Oxidizer Temperature, OF            |        | 65           | 70                 |
|            | Fuel Temperature, °F                |        | 65           | 70                 |
|            | Oxidizer Inlet Pressure, psia       | 2      | 85.4         | 292                |
|            | Fuel Inlet Pressure, psia           | 2      | 94.7         | 292                |
| •          | Oxidizer Flowrate, lbs/sec          | 4      | 0461         | .0468              |
| •          | Fuel Flowrate, lbs/sec              |        | 0359         | 0354               |
|            | Mixture Ratio, o/f (1.30+6%)        | •      | 1.29         | 1.32               |
| *-         | Thrust, 1bs (23.0+5%)               | . ·    | 22.8         | 23.0               |
|            | Specific Impulse                    |        | 279          | 280                |
|            | Start Time, msec (25 max)           |        | 15           |                    |
|            | Shutdown Impulse, lb-sec (.260 max) | *      | 17675        |                    |
|            | Oxidizer Valve Voltage, volts       | -      | 29.3         |                    |
|            | Fuel Valve Voltage, volts           | پيو    | 28.3         |                    |
| •          | Oxidizer Valve Current, amps        |        | .690         | •                  |
|            | Fuel Valve Current, amps            | •      | 673          |                    |
|            | Electrical Power, watts             | •      | 39.3         |                    |
|            | * Ref: ECN NA-SE6-289Rl             | •      |              | •                  |
|            | · Mary may do coyle                 |        |              |                    |
|            | arphi                               |        |              | . (                |

| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# PART NO. (MAC 52-52701-265) |            |          |          |          |  |
|--|------------|----------|----------|----------|--|
| NAME OF TEST DAT DUTY CYCLE TO 118 SECOIDS TEST NO 208160-SHEET OF       |            |          |          |          |  |
| NAME OF TEST DATE BOTT OF OHE TO ALSO SEACCEDS TO                        | ST NO. 200 | my-SKEE  | TOF      | _        |  |
| Sequence Number 4  |            |          |          |          |  |
| Pulse Number   | 2          | 8        | 26       |          |  |
| Signal Width, msec   | 20.3       | 20.4     | 20.5     | •        |  |
| Start Time, msec (25 max.)   | 10.1       | 10.3     | 10.9     |          |  |
| Environmental Pressure, psia   | .022       | .022     | .022     |          |  |
| Environmental Temperature, OF  | 70         | 70       | 70       |          |  |
| Oxidizer Inlet Temperature, OF   | 70         | 70       | 70       |          |  |
| Fuel Inlet Temperature, or   | 70         | 70       | 70       |          |  |
| Oxidizer Inlet Pressure, psia  | 292        | 292      | 292      |          |  |
| Fuel Inlet Pressure, psia  | 292        | 292      | 292      |          |  |
| Total Oxidizer Flow, 1bs   | *          | · *      | H-       |          |  |
| Total Fuel Flow, 1bs   | *          | <b>H</b> | <b>-</b> |          |  |
| Mean Mixture Ratio, o/f  | *          | *        | *        |          |  |
| Pulse Total Impulse, 15-sec  | .4779      | .4329    | 4089     |          |  |
| Mean Specific Impulse, sec   | *          | st.      | *        |          |  |
| Shutdom Impulse, 1b-sec (.260 max) **                                    | 1913       | 1720     | 1475     |          |  |
| Cut-Off Time, msec   | . 13.5     | 12.4     | 10.6     |          |  |
| Oxidizer Valve Voltage, volts  | 26         | 26       | 26       | <i>:</i> |  |
| Fuel Valve Voltage, volts  | 76         | 26       | 26       |          |  |
| Oxidizer Valve Current, amps   | ,659       | .659     | ,659     |          |  |
| Fuel Valve Current, amps .   | 642        | 1642     | 642      |          |  |
| Electrical Power, watts  | 33.8       | 33.8     | 33.8     |          |  |
| * Flows Unreadable Instrumentation Problems ** Ref: ECN NA-SE6-289Rl     |            |          |          |          |  |
| Prepared by: Checked by: Approved for MA by:                             |            |          |          |          |  |
| FORM 600-8-37 NEV 6-63   |            | KICO     |          |          |  |
| rukm.cuo-8-3/ NEW 8-83   |            | •        |          |          |  |

| COMPONENT N  | AME THRUST CHAIRER ASSEMBLY - 25#   | MAC_            | 52-52701-265       |
|--------------|-------------------------------------|-----------------|--------------------|
| <del>-</del> |                                     | ART NO. T NAA_  | 203160-61          |
| NAME OF TEST | DAT DUTY CYCLE TO 118 SECONDS       | TEST NO. 203760 | 2–ŠFETOF           |
| •            | Sequence Number 5                   | _               |                    |
|              | Pulse Number 3                      | Site<br>Data    | Standard<br>Vacuum |
|              |                                     |                 | Vasaut             |
|              | Firing Duration, sec                | .690            |                    |
|              | Accumulated Firing Time, sec        | 26.5            |                    |
|              | Data Slice Number                   | 3               | •                  |
| •            | Time of Data Slice, sec             | 165             |                    |
|              | Environmental Pressure, psia        | 1022            | 0                  |
|              | Environmental Temperature, F        | 67 (VH          | c.chamber)         |
|              | Oxidizer Temperature, or            | 65.             | 70                 |
| •            | Fuel Temperature, F                 | . 65            | 70                 |
|              | Oxidizer Inlet Pressure, psia       | 285.4           | 292                |
|              | Fuel Inlet Pressure, psia           | 293.7           | 292                |
|              | Oxidizer Flowrate, lbs/sec          | 1461            | . 1468             |
| •            | Fuel Flowrate, lbs/sec              | .0359           | ,0355              |
|              | Mixture Ratio, o/f (1.30+6%)        | 1,29            | 1.32               |
|              | Thrust, 1bs (23.0+5%)               | 23,0            | 23.2               |
|              | Specific Impulse                    | .280            | 282                |
|              | Start Time, msec (25 max)           | . 14            | •                  |
| •            | Shutdown Impulse, 1b-sec (.260 max) | 1624            |                    |
|              | Oxidizer Valve Voltage, volts       | 29.6            |                    |
|              | Fuel Valve Voltage, volts           | 28.6            |                    |
|              | Oxidizer Valve Current, amps        | . 184           |                    |
|              | Fuel Valve Current, amps            | .667            | · .                |
| • .          | Electrical Power, watte             | 39.3            | ·                  |
|              | * Ref: ECN NA-SE6-289R1             | <del></del>     |                    |

Propared by:

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Chacked by:

Chacked by:

| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# | PART NO { N | AC 52-52701.<br>AA 208160<br>160-58-FT |          |
|--|-------------|--|----------|
| Sequence Number                              |             |  |          |
| Pulse Number                                 | 3           | 14                                     |          |
| Signal Width, msec                           | 23.7        | 23.5                                   |          |
| Start Time, msec (25 max.)                   | 11.0        | 11.2                                   |          |
| Environmental Pressure, psia                 | ,022        | .022                                   |          |
| Environmental Temperature, OF                | 70          | 70                                     |          |
| Oxidizer Inlet Temperature, F                | 70          | 70                                     |          |
| Fuel Inlet Temperature, oF                   | 70          | 70                                     |          |
| Oxidizer Inlet Pressure, psia                | 292         | 292                                    |          |
| Fuel Inlet Pressure, psia                    | 292         | 292                                    | ·        |
| Total Oxidizer Flow, lbs                     | *           | ¥                                      |          |
| Total Fuel Flow, 1bs                         | *           | *                                      |          |
| Mean Mixture Ratio, o/f                      | *           | *                                      |          |
| Pulse Total Impulse, 1b-sec                  | 5100        | 4898                                   |          |
| Mean Specific Impulse, sec                   | *           | ×                                      |          |
| Shutdown Impulse, 1b-sec (.260 max) **       | 1832        | 1678                                   |          |
| Cut-Off Time, msec                           | .9.5        | 8.4                                    |          |
| Oxidizer Valve Voltage, volts                | 26          | 26                                     |          |
| Fuel Valve Voltage, volts                    | 26          | 26                                     |          |
| Oxidizer Valve Current, amps                 | .659        | .659                                   |          |
| Fuel Valve Current, amps .                   | .642        | ,642                                   |          |
| Electrical Power, watts                      | 33.8        | 33.8                                   |          |
| * Flows Unreadable - Instrumentation P       | roblems     |  |          |
| ** Ref: ECN NA-SE6-289RL                     |             |  |          |
| Prepared by: Checked by:                     | Appr        | design in                              | M by:    |
| C.M 608-4-37 NEW 6-63                        | ally K      | <u>Zaloco</u>                          | <i>-</i> |
| CHA 000-B-31 MEM 0-03                        |             | R–15                                   | 019-2    |

| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# P                         | ARI NO. ( N | AC 52-5270<br>AA 208160 |             | <del></del>                            |  |  |  |  |  |
|--|-------------|-------------------------|-------------|--|--|--|--|--|--|
| NAME OF TEST DAT DUTY CYCLE TO 118 SECONDS T                           | EST NO. 200 | 1160-SKEE               | ror_        |  |  |  |  |  |  |
| Sequence Number 7  |             |                         |             |  |  |  |  |  |  |
| Pulse Number   | 17          | 101                     | <del></del> | 7                                      |  |  |  |  |  |
| Signal Width, msec   | 36.1        | 37.1                    |             | 1.                                     |  |  |  |  |  |
| Start Time, msec (25 max.)   | 13.0        | 13.1                    |             | 1                                      |  |  |  |  |  |
| Environmental Pressure, psia   | .022        | ,022                    |             | 1                                      |  |  |  |  |  |
| Environmental Temperature, or  | 70          | 70                      |             | 1                                      |  |  |  |  |  |
| Oxidizer Inlet Temperature, OF   | 70          | 70                      |             | 1                                      |  |  |  |  |  |
| Fuel Inlet Temperature, or   | 70          | 70                      |             | 7                                      |  |  |  |  |  |
| Oxidizer Inlet Pressure, psia  | 292         | 292                     |             | 1                                      |  |  |  |  |  |
| Fuel Inlet Pressure, psia  | 292         | 292                     |             | 1                                      |  |  |  |  |  |
| Total Oxidizer Flow, lbs   | *           | *                       |             | 1                                      |  |  |  |  |  |
| Total Fuel Flow, 1bs   | *           | *                       | <del></del> | 7                                      |  |  |  |  |  |
| Mean Mixture Ratio, o/f  | *           | *                       |             | 1                                      |  |  |  |  |  |
| Pulse Total Impulse, 1b-sec  | .8166       | ,8382                   |             | 1                                      |  |  |  |  |  |
| Mean Specific Impulse, sec   | *           | *                       |             | 7                                      |  |  |  |  |  |
| Shutdown Impulse, 1b-sec (.260 max) **                                 | 1832        | .1867                   |             | 1                                      |  |  |  |  |  |
| Cut-Off Time, msec   | . 9.7       | 10.4                    |             | 1                                      |  |  |  |  |  |
| Oxidizer Valve Voltage, volts  | 26          | 26                      |             | 7 :                                    |  |  |  |  |  |
| Fuel Valve Voltage, volts  | 26          | 26                      |             | 7                                      |  |  |  |  |  |
| Oxidizer Valve Current, smps   | ,659        | .659                    |             | 1                                      |  |  |  |  |  |
| Fuel Valve Current, amps .   | 1642        | .642                    |             | 1                                      |  |  |  |  |  |
| Electrical Power, watts  | 33.8        | 33.8                    | •           | ]                                      |  |  |  |  |  |
| * Flows Unreadable - Instrumentation Problems ** Ref: ECN NA-SE6-289Rl |             | •                       |             | -                                      |  |  |  |  |  |
| Prepared by: Checked by:  11. De luison  FORM 600-8-17 NEW 6-63        |             |                         |             |  |  |  |  |  |  |
| FORM 600-8-37 NEW 6-63   | 7           |                         |             | ************************************** |  |  |  |  |  |

R-15019-2

| COMPONENT NAME THRUST CHAIRER ASSEMBLY - 25# NAME OF TEST DAT DUTY CYCLE TO 118 SECONDS                 | PART NO. { MAC _52-52701-265<br>NAA _208160-61<br>TEST NO. 203160-SHEETOF   |
|---|---|
| •   | Site Standard Data Vacuum  .690 35.2  4 .65 .022 0 .72 (vac.clinmber) .65 70 .65 70 .285.4 292 .293.7 292 .0461 .0468 .0359 .0355 .129 .132 .22.4 22.6 .273 275 .15 |
| Fuel Valve Voltage, volts Oxidizer Valve Current, emps Fuel Valve Current, emps Electrical Power, watts | 28.3<br>.679<br>.673<br>39.0  |
| * Ref: ECN NA-SE6-289RL   |   |

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| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# F                              | PART NO. | AC 52-5270] | L <b>-</b> 265          |   |
|---|----------|-------------|-------------------------|---|
| NAME OF THE DATE DATE DITTE OFFICE OF THE STREET                            | CN       | 0160-SHEET  | OF                      |   |
| Sequence Number 9   | and and  |             | Professional Publishers | - |
| Pulse Number  | 2        | 4           | <del></del>             | 1 |
| Signal Width, msec  | 32.5     | 32.5        |                         | 1 |
| Start Time, msec (25 max.)  | 10.1     | 10.1        |                         | 1 |
| Environmental Pressure, psia  | ,022     | .022        |                         | 1 |
| Environmental Temperature, oF   | 70       | 70          |                         | 1 |
| Oxidizer Inlet Temperature, OF  | 70       | 70          |                         | 1 |
| Fuel Inlet Temperature, F   | 70       | 70          |                         | 1 |
| Oxidizer Inlet Pressure, psia   | 292      | 292         |                         | 1 |
| Fuel Inlet Pressure, psia   | 292      | 292         |                         | ] |
| Total Oxidizer Flow, 1bs  | *        | *           | •                       | 1 |
| Total Fuel Flow, 1bg  | *        | *           |                         | 1 |
| Mean Mixture Ratio, o/f   | *        | *           |                         | 1 |
| Pulse Total Impulse, 1b-sec .   | .8011    | .2727       |                         | 1 |
| Mean Specific Impulse, sec  | *        | . 4         |                         | 1 |
| Shutdown Impulse, 1b-sec (.260 max) **                                      | 7046     | 1889        |                         | 1 |
| Cut-Off Time, msec  | .11.2    | 11.0        |                         | 1 |
| Oxidizer Valve Voltage, volts   | 26       | 26          |                         | 1 |
| Fuel Valve Voltage, volts   | 26       | 26          |                         | 1 |
| Oxidizer Valve Current, amps_   | .659     | .659        |                         | 1 |
| Fuel Valve Current, amps  | 1642     | .642        |                         | ] |
| Electrical Power, watts   | 33.8     | 33.8        |                         | ] |
| * Flows Unreadable - Instrumentation Problems ** Ref: ECN NA-SE6-289RL      |          |             |                         | - |
| Propared by: Chocked by: Chocked by: 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. | Appr     | go'd for 11 |                         |   |
|   | 7        |             |                         |   |

| COMPONENT NAMETHRUST_CHAMBER_ASSEMBLY = 25#  NAME OF TESTDAT_DUTY_CYCLE_TO_118_SECONDS | PART NO.    | AC 52-527         | 0       |   |
|--|-------------|-------------------|---------|---|
| NAME OF TEST DAT DUTY CYCLE TO 118 SECONDS   | TEST NO. 20 | <u> 3160-312E</u> | TOF     |   |
| Sequence Number 10   |             |                   |         |   |
| Pulse Number   | 4           | 8                 | 543     |   |
| Signal Width, msec   | 58.5        | 58.6              | 58.0    | · |
| Start Time, msec (25 max.)   | 8.7         | 9.0               | 8.7     | l |
| Environmental Pressure, psia   | ,022        | 1022              | ,022    | 1 |
| Environmental Temperature, oF  | 70          | 70                | 70      |   |
| Oxidizer Inlet Temperature, OF   | 70          | 70                | 70      |   |
| Fuel Inlet Temperature, or   | 70          | 70                | 70      |   |
| Oxidizer Inlet Pressure, psia  | 292         | 292               | 292     |   |
| Fuel Inlet Pressure, psia  | 292         | 292               | 292     |   |
| Total Oxidizer Flow, 1bs   | *           | *                 | 24      | l |
| Total Fuel Flow, lbs   | *           | *                 | *       | ĺ |
| Mean Mixture Ratio, o/f  | *           | *                 | *       |   |
| Pulse Total Impulse, 1b-sec  | 1.4799      | 1.4613            | 1.4327  |   |
| Mean Specific Impulse, sec   | *           | ¥                 | xt.     |   |
| Shutdom Impulse, 1b-sec (.260 max) **  | 1849        | . 1898            | .1756   |   |
| Cut-Off Time, msec   | 11.8        | 14.7              | 13.5    | l |
| Oxidizer Valve Voltage, volts  | 26          | 26                | 26      |   |
| Fuel Valve Voltage, volts  | 26          | 26                | 26      |   |
| Oxidizer Valve Current, amps   | .659        | .659              | .659    |   |
| Fuel Valve Current, amps .   | 1642        | 642               | 642     |   |
| Electrical Power, watts  | 33.8        | 33.8              | 33.8    |   |
| * Flows Unreadable - Instrumentation Problems ** Ref: ECN NA-SE6-289Rl                 | •           |                   |         | • |
| Prepared by: Checked by: ///   | Appr        | ord for           | MAA hve |   |

| COMPONENT NAMETHRUST_CHAPIBER ASSETBLY - 25# | PART NO { MAC 52-52701-265   |
|--|--|
| NAME OF TEST DAT DUTY CYCLE TO 118 SECONDS   | TEST NO 208160-SHEETOF_  |
| Sequence Number //                           | The second second second principle and the second s |
| Pulse Number                                 | 16   |
| Signal Width, msec                           | 36.1   |
| Start Time, msec (25 max.)                   | 10.0   |
| Environmental Pressure, psia                 | .022   |
| Environmental Temperature, or                | 70   |
| Oxidizer Inlet Temperature, or               | 20   |
| Fuel Inlet Temperature, or                   | 70   |
| Oxidizer Inlet Pressure, psia                | 292  |
| Fuel Inlet Pressure, psia                    | 292  |
| Total Oxidizer Flow, 1bs                     | *  |
| Total Fuel Flow, 1bs                         | *  |
| Mean Mixture Ratio, o/f                      | *  |
| Pulse Total Impulse, 1b-sec                  | .8798  |
| Mean Specific Impulse, sec                   | *  |
| Shutdown Impulse, 1b-sec (.260 max) **       | ,2096  |
| Cut-Off Time, msec                           | .15.4  |
| Oxidizer Valve Voltage, volts                | 26   |
| Fuel Valve Voltage, volts                    | 26   |
| Oxidizer Valve Current, amps                 | .659   |
| Fuel Valve Current, amps .                   | .642   |
| Electrical Power, watts                      | 33.8   |
| * Flow Unreadable - Instrumentation Pro      |  |
| ** Ref: ECN NA-SE6-289RL                     |  |
| Prepared by: Checked by:  1) / Medicina      | Approvious ina by:   |
| FORM 608-8-37 NOV 6-63                       | 0 13   |

| COMPONENT NAME THRUST CHAIRER ASSELBLY = 254  | PART NO.                              | 52-52701-265<br>208160-61                      |
|---|---------------------------------------|--|
| NAME OF TEST DAT DITY CYCLE TO 118 SECONDS  | _ TEST NO. 20116                      | O-SKEET_OF_                                    |
| Sequence Number 15 Pulse Number 4   | Site<br>Data                          | Standard<br>Vacuum                             |
| Firing Duration, sec  Accumulated Firing Time, sec  Data Slice Number                       | 73.4                                  |  |
| Time of Data Slice, sec<br>Environmental Pressure, psia                                     | -65                                   | 0  |
| Environmental Temperature, °F<br>Oxidizer Temperature, °F<br>Fuel Temperature, °F           | 75 (VX<br>65<br>. 65                  | 1 <i>c. ch 1</i> 9 m b <i>ar</i> )<br>70<br>70 |
| Oxidizer Inlet Pressure, psia Fuel Inlet Pressure, psia Oxidizer Flowrate, lbs/sec          | 283.5<br>293.7                        | 292<br>292                                     |
| Fuel Flowrate, lbs/sec Mixture Ratio, o/f (1.30+6%)   | 1.29                                  | .0470<br>.0356<br>.1.32                        |
| Thrust, lbs (23.0+5%) Specific Impulse Start Time, msec (25 max)                            | 22.5<br>275<br>14                     | 22.8   |
| Shutdown Impulse, 1b-sec (.260 max) Oxidizer Valve Voltage, volts Fuel Valve Voltage, volts | * <u>12156</u><br><u>29.4</u><br>28.5 | •  |
| Oxidizer Valve Current, amps  | 1660                                  |  |
| Electrical Power, watts   | 38.8                                  |  |

Propared by:

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Checkery by

\* Ref: ECN NA-SE6-289R1

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11-15019-2

| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# F                            | ART NO. | C 52-52701-   | 265  |             |
|---|---------|---|--|-------------|
| NAME OF TEST DAT DUTY CYCLE TO 118 SECONDS 1                              |         | . h01   | OF   |             |
| Sequence Number 17  |         | The second second second second second second second second second second second second second second second se | The second secon |             |
| Pulse Number  | 11      |   |  | 1           |
| Signal Width, msec  | 527     |   |  | 1.          |
| Start Time, msec (25 max.)  | 9.2     |   |  | 1           |
| Environmental Pressure, psia  | 1022    |   |  | ]           |
| Environmental Temperature, OF   | 70      | ·   |  | 1           |
| Oxidizer Inlet Temperature, Or  | 70      |   |  | ]           |
| Fuel Inlet Temperature, F   | 70      |   |  |             |
| Oxidizer Inlet Pressure, psia   | 292     |   |  | ]           |
| Fuel Inlet Pressure, psia   | 292     |   |  |             |
| Total Oxidizer Flow, lbs  | +       |   |  | ]           |
| Total Fuel Flow, 1bs  | * .     |   |  |             |
| Mean Mixture Ratio, o/f   | ·#      |   |  |             |
| Pulse Total Impulse, 1b-sec .   | 1.4451  |   |  | ]           |
| Mean Specific Impulse, sec  |         |   |  | ]           |
| Shutdown Impulse, 1b-sec (.260 max)**                                     | 12377   |   |  | ]           |
| Cut-Off Time, msec  | . 15.8  |   |  | ] :         |
| Oxidizer Valve Voltage, volts   | 26      |   |  | ];          |
| Fuel Valve Voltage, volts   | 26      |   |  | ]           |
| Oxidizer Valve Current, amps  | 1659    |   |  |             |
| Fuel Valve Current, cmps  | .642    |   |  | ]           |
| Electrical Power, watts   | 33.8    |   | .·   | J           |
| * Flows Unreadable - Instrumentation Problems<br>** Ref: ECN NA-SE6-289R1 |         |   |  |             |
| Propared by: Chooked by: / //   | Vobre   | CO COT HAA  | by:  |             |
| FORT 508-8-37 NEW 6-63  |         | 100   | 4-2- <b></b>   | <del></del> |

| COMPONENT NAME THRUST CHAIRER ASSEMBLY - 25# | . PART | NO { MAC 52-52701-265<br>NAA 208160-61 |
|--|--------|--|
| NAME OF TEST DAT DUTY CYCLE TO 118 SECONDS   | . Test | NO. 203160-SHEET_OF_                   |

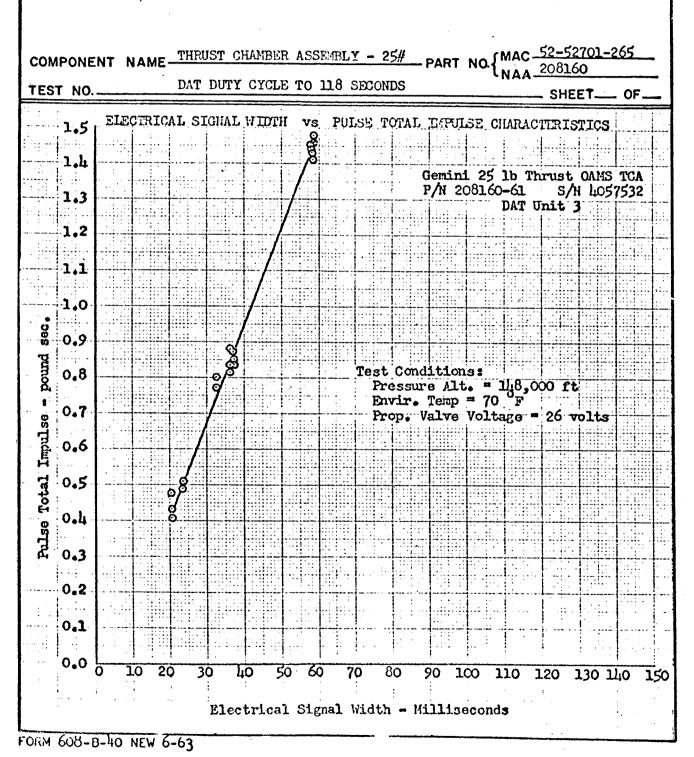
| Sequence Humber 23                   | Site           | Standard    |
|--------------------------------------|----------------|-------------|
| Pulse Number 4                       | Data           | Vacuum      |
| Firing Duration, sec                 | .690           | <del></del> |
| Accumulated Firing Time, sec         |                |             |
| Data Slice Number                    | <u>//3</u>     | •           |
| Time of Data Slice, sec              | <u>_6</u>      | •           |
|                                      | 165            |             |
| Environmental Pressure, psia         | 1022           | 0           |
| Environmental Temperature, F         | 85 (VH         | c.chamber)  |
| Oxidizer Temperature, OF             | 65             | 70          |
| Fuel Temperature, OF                 | 65             | 70          |
| Oxidizer Inlet Pressure, psia        | 282.5          | 292         |
| Fuel Inlet Pressure, psia            | 292.7          | 292         |
| Oxidizer Flowrate, 1bs/sec           | .0461          | 10472       |
| Fuel Flowrate, lbs/sec               | .0359          | ,0356       |
| Mixture Ratio, o/f (1.3046%)         | 1.29           | 1.33        |
| Thrust, 1bs (23.0+5%)                | 22./           | 22.4        |
| Specific Impulse                     | 269            | 271         |
| Start Time, msec (25 max)            | 14             |             |
| Shutdown Impulse, 1b-sec (.260 max)* | -              |             |
| •                                    | <u>,2529</u> . | •           |
| Oxidizer Valve Voltage, volte        | 29.4           |             |
| Fuel Valve Voltage, volts            | 28.5           | •           |
| Oxidizer Valve Current, amps         | 1662           |             |
| Fuel Valve Current, amps             | .654           |             |
| Electrical Power, watto              | 38.1           | •           |
|                                      |                |             |

\* Ref: ECN NA-SE6-289Rl

Prepared by: Chacked by:

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| COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# PART NO. { MAC 52-52701-265 NAA 208160 |              |              |                           |   |  |  |  |  |  |  |
|---|--------------|--------------|---------------------------|---|--|--|--|--|--|--|
| NAME OF TEST DAT DUTY CYCLE TO 118 SECONDS  | TEST NO. 200 | 33.60-SHEET  | OF                        |   |  |  |  |  |  |  |
| Sequence Number 25  |              |              | 14.544 (44.1 K.) (4.1 K.) |   |  |  |  |  |  |  |
| Pulse Number  | 2            | フ            |                           |   |  |  |  |  |  |  |
| Signal Width, msec  | 58.3         | 57.8         | ·                         | • |  |  |  |  |  |  |
| Start Time, msec (25 max.)  | 12.0         | 10.5         |                           |   |  |  |  |  |  |  |
| Environmental Pressure, psia  | ,022         | .022         |                           |   |  |  |  |  |  |  |
| Environmental Temperature, or   | 20           | 70           |                           |   |  |  |  |  |  |  |
| Oxidizer Inlet Temperature, OF  | 70           | 70           |                           |   |  |  |  |  |  |  |
| Fuel Inlet Temperature, or  | 70           | 70           |                           |   |  |  |  |  |  |  |
| Oxidizer Inlet Pressure, psia   | 292          | 292          |                           |   |  |  |  |  |  |  |
| Fuel Inlet Pressure, psia   | 292          | 292          |                           |   |  |  |  |  |  |  |
| Total Oxidizer Flow, 1bs  | 4            | *            |                           |   |  |  |  |  |  |  |
| Total Fuel Flow, 1bs  | * .          | *            |                           |   |  |  |  |  |  |  |
| Mean Mixture Ratio, o/?   | *            | *            |                           |   |  |  |  |  |  |  |
| Pulse Total Impulse, 1b-sec   | 1.4110       | 1.4582       |                           |   |  |  |  |  |  |  |
| Mean Specific Impulse, sec  | *            | *            |                           |   |  |  |  |  |  |  |
| Shutdown Impulse, 1b-sec (.260 max) *   | ,2596        | ,3036        |                           |   |  |  |  |  |  |  |
| Cut-Off Time, msec  | 122,5        | 22.9         |                           |   |  |  |  |  |  |  |
| Oxidizer Valve Voltage, volts   | 26           | 26           |                           |   |  |  |  |  |  |  |
| Fuel Valve Voltage, volts   | 26           | 26           |                           |   |  |  |  |  |  |  |
| Oxidizer Valve Current, amps  | .659         | .6.59        |                           |   |  |  |  |  |  |  |
| Fuel Valve Current, amps  | 642          | 1642         |                           |   |  |  |  |  |  |  |
| Electrical Power, watts   | 33.2         | 33.8         | •                         |   |  |  |  |  |  |  |
| * Ref: ECN NA-SE6-289RL   |              |              | ·                         |   |  |  |  |  |  |  |
| Prepared by:  Checked by:  FURN 600-U-3 (NEW 0-03)                                  | App          | or of sor in | VV pa:                    | _ |  |  |  |  |  |  |



|  |          |   |               |           |      |       |           |     | İ     |      |   |      |          |   |       |               |    |         |    |             |     |              |              |          |       |         |       | ō    |
|--|----------|---|---------------|-----------|------|-------|-----------|-----|-------|------|---|------|----------|---|-------|---------------|----|---------|----|-------------|-----|--------------|--------------|----------|-------|---------|-------|------|
| ()- T                                  |          | 7   | نبر (د<br>س   |           |      |       |           |     |       |      |   |      |          |   |       |               |    |         |    |             |     |              |              |          |       |         |       | ç    |
|  |          |   | <b>(</b> Σ= = | (;)~\<br> | es t |       |           | -0> |       | 1 10 | X |      | ()<br>() |   | 2     | * <b>\$</b> 1 | 0  | );;<br> | ΥΩ | τ.′         | Tu. | <b>2</b> 11. | )<br>        |          |       |         |       | P    |
|  |          |   |               |           |      |       |           |     |       |      |   |      |          |   |       |               |    |         |    | 13.         | /   | >            |              |          |       |         |       | Ç    |
|  |          |   |               |           |      |       |           |     |       |      |   |      |          |   |       |               |    |         |    |             |     |              | <i>\( \)</i> | <b>.</b> | دېد   |         | 2     |      |
|  |          |   |               |           |      |       |           |     |       |      |   |      |          |   |       |               |    |         |    |             |     |              |              |          |       |         | ?     | ç    |
|  |          |   |               |           |      |       |           |     |       |      |   |      |          |   |       |               |    |         |    |             |     |              |              |          |       |         | ,<br> |      |
|  | 11       |   |               |           |      |       |           |     |       |      |   |      |          | i |       |               |    |         |    |             |     |              |              |          |       |         |       | 121  |
|  | E-       |   |               |           |      |       |           |     |       |      |   |      |          |   |       |               |    |         |    |             |     |              |              |          |       |         |       | c    |
| 13                                     | r. rune  |   |               |           |      |       |           |     |       |      |   |      |          |   |       |               |    |         |    |             |     |              |              |          |       | 5       |       | -    |
| E 140                                  |          |   |               |           |      |       |           |     |       |      |   |      |          |   |       | å             |    |         |    |             |     |              |              |          |       | I       |       | Cot  |
| 2.5                                    |          |   |               |           |      |       |           |     |       |      |   |      |          |   |       | 17.           |    | E .     |    |             |     |              |              |          |       | I.      |       |      |
| E 23                                   | 130      |   |               | 70        |      |       |           |     |       |      |   |      |          |   |       | 3<br>5<br>0   |    | =       |    |             |     |              |              |          |       | -<br> - |       | CLC  |
|  | <b>.</b> |   | T.CO.         |           |      |       |           |     |       |      |   |      |          |   |       |               |    | -       | 67 |             |     |              |              |          | Į     |         |       |      |
|  | <u>C</u> | Ę   |               |           |      | :::1- |           |     |       |      |   |      |          |   |       | C             | 41 | Π.      | о. |             |     |              |              |          | Υ<br> |         |       | p    |
|  |          | 7   | , 5/i         | 13<br>13  |      |       |           |     | ::::. |      |   |      |          |   |       |               |    |         |    |             |     |              |              |          |       |         |       | Ç    |
|  |          | 5   | 50,433        | 5 5       |      |       |           |     |       |      |   |      |          |   |       |               |    |         |    |             |     |              | 1::::        | <i>}</i> |       |         |       |      |
|  |          | Chief Age Age and Age |               | 13        |      |       |           |     |       |      |   | 1777 |          |   |       |               |    |         |    |             |     |              | 1            | 1        | 1     |         |       | ¢    |
|  |          | 7.7.1   |               | Sotod     |      |       |           |     |       |      |   |      |          |   |       |               |    |         |    |             |     |              |              |          |       |         |       |      |
|  |          |   |               | -1        |      |       | : : : · . |     |       |      |   |      |          |   |       |               |    |         |    |             |     | To S         |              |          |       |         |       | C    |
| ·· • · • • • • • • • • • • • • • • • • |          |   |               |           |      |       |           |     |       | l l  |   |      |          |   |       |               |    |         |    | 1           | :   |              | 77           | ა.       | -     |         |       | T    |
| 上上                                     | : 1      |   |               |           |      | 3     |           |     | 3     |      |   | 1    |          |   | <br>學 |               |    | :       | 3  | :<br>}:<br> |     | ; ;          | þ            | : :      |       |         | 3     | ے ار |

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| •              |                |          |              | r MAC          | 52-52701-265 |
|----------------|----------------|----------|--------------|----------------|--------------|
| COMPONENT NAME | TERUST CHAPBER | ASSE BLY | <u>~ 25#</u> | PART NO.       | 208160_61    |
| NAME OF TESTB  |                |          |              | _TEST N@08160_ | _SAEETOF     |

Deviation Request:

The Burst Pressure Test data of paragraph 7.3.3.2.3 will be completed when data is available. Proceed with the Weight Determination of paragraph 6.6 and 7.3.3.2.4.

Recopied from original request dated 12 November 1964.

E. Adams

Gemini Dat-Rat Unit

James D. Mavrogenis
MAC Engineering

12-18-14

FORM 608-B-37 NEW 6-63

| COMPONENT NAM   | E THRUST CHAMBER ASSEMBLY - 25#   | PART NO SMAC_  | 52-52701-265                         |  |  |  |
|---|---|--|--------------------------------------|--|--|--|
| NAME OF TEST_   | RURST TREESTOR  | TEST NO. 203160  | 208160-61-<br>401<br>SHEET 2520F 300 |  |  |  |
| D   |   | of particles of the second of the second bank to reserve you |                                      |  |  |  |
| References  | MAC SCD 52-52701, Revision F, paragr  | C SCD 52-52701, Revision F, paragraph 6.3.1.3.2.2            |                                      |  |  |  |
| 7.3.3   |   |  |                                      |  |  |  |
| 7.3.3.1   | Test Procedure  | •  |                                      |  |  |  |
| 7.3.3.1.1   | Open the oxidizer and fuel facility by-pass valves. See Figure 6.   |  |                                      |  |  |  |
| 7.3.3.1.2   | Close the facility propellant valves  |  |                                      |  |  |  |
| 7.3.3.1.3 Adjust the test facility propellant tank pressures to 750 ±0.20 The parameters to be recorded during the firing test are combustion chamber exterior wall temperature, facility propellant tank pressures, TCA inlet pressures, and thrust. |   |  |                                      |  |  |  |
| 7.3.3.1.4   | Activate instrumentation.   |  | •••                                  |  |  |  |
| 7.3.3.1.5   | Open the TCA propellant valves.   | •  | • ••                                 |  |  |  |
| 7.3.3.1.6 Within one second after TCA propellant valve opening, of facility propellant valves simultaneously.   |   |  |                                      |  |  |  |
| 7.3.3.1.7   | Fire the TCA for three seconds following facility propellant valve opening. The firing test shall be terminated by closing the TCA propellant valves. |  |                                      |  |  |  |
| 7.3.3.1.8   | The TCA shall demonstrate operation failure as defined in Table II, note  | vithout catastr  | ophic chamber                        |  |  |  |
| 7.3.3.1.9   | Perform decontamination per paragrap  | h 6.8.   |                                      |  |  |  |
| 7.3.3.1.10  | Perform weight determination per par  | agraph 6.6.  | •                                    |  |  |  |
| •   | •   | •  | <u>-</u>                             |  |  |  |
|   |   | ·  | •                                    |  |  |  |

|                          |  |         | •  | *      |
|--------------------------|--|---------|--|--------|
| PREPARED BY: DATE        | APPROVED FOR NAA:  | DATE    | APPROVED FOR MCDONNELL:  | DATÉ   |
| J.A. Ganger 10-6-64      | (1) A  | •       |  | - OAIE |
| CHECKED BY: CATE         | 1/1/5:00   | 10-8-64 |  |        |
| RC010 10-8-61            | 17 10000   | 10 0 07 |  |        |
| FURN 601-19-98 1811 6-62 | S. Commission of | 1       | COMMONWEAL AND ADDRESS OF THE PARTY OF THE P | -      |

R-15019-2

| COMPONENT NAM         | THRUST CHAMBER ASSEMBLY - 25# PART NO MAC 203160-61  BURST PRESSURE TEST NO 203160-SHEET 3530F 380   |
|-----------------------|--|
| NAME OF TEST          | Test Data - TCA #3   |
| 7.3.3.2.1             | Component Identification   |
|                       | Component Name  SL7-TCA 25#   KcDonnell Part No. 52-52701-265  |
|                       | McDonnell Part No. 52-52701 - 265  |
|                       | Rocketdyne Part No. 208160-61  |
| ·                     | Component Serial No. 4057532 0 6 3   |
|                       | Accumulated Acceptance Test Firing Time, seconds  Accumulated Cape Cycle and MDC Firing Time, sec.   |
|                       | Throat Diameter, inches (Average of four measurements)   |
|                       | Nozzle Exit Diameter, inches   |
| 7.3.3.2.2             | Propellant Samples   |
| •                     | Nitrogen Monomethyl Tetroxide Hydrazine  |
|                       | Sample Date 11-2-64 11-2-6 1   |
| • .                   | Sample Batch Number  |
|                       | Sample Temperature, F 60° 77° 6  |
|                       | Sample Specific Gravity 1.46/ 873 63   |
|                       | Hot Hil Spec. Requirements (Yes or No) 1 yes yes   |
| PREPARED BY  B. Adams | DATE FERTORIED BY DATE CHITESCED FOR MAA DATE CHITESTED FOR MODDINGLY DATE CHITESTED FOR MODIFICATION OF CHITESTED FOR MODIF |

R-15019-2

| COMPONENT NA  | THRUST CHAMBER ASSEMBLY - 25#  | _ PART NO { MAC _ 52-52701-265   NAA _ 208160-61   MAC _ 208160-61 |
|---------------|--|--|
| NAME OF TEST. | BURST PRESSURE   | TEST NO. 208160- SHEET 3540F 38  |
| - T           |  |  |
| 7.3.5.2.3     | Site Data  |  |
|               | Facility oxidizer tank pressure (                                    | psig) <u>750.</u> (750 +0)   |
| •             | Facility oxidizer tank pressure ( Facility fuel tank pressure (psign | (750 + 0)  |
| <b>:</b> .    | Oxidizer inlet pressure (psia)                                       | 737.   |
| •             | Fuel inlet pressure (psia)   | 245.   |
|               | Thrust (lbs)   | 55   |
|               | Combustion chamber exterior wall                                     | temperature <u>835</u> (700 F max)   |
| •             | Chamber Pressure, calculated, (psi                                   | (a) 1320·)   |
|               | •  |  |

| Į.               |                   |                        |                            |
|------------------|-------------------|------------------------|----------------------------|
| PREPARED BY DATE | PERFORMED CY DATE | WITHESSED FOR NAA CATE | COTTIFED FOR MCDONNELL DAT |
| E. Adams         |                   | 1 1 Atial              |                            |
| E. Adams 4/10/64 | HIC               | 1 Shirt                | VERTICED BY USAF DAT       |
| 1 2, 7,          | •                 | 1 10 1 1               |                            |

FORM 608-B-39 NEW 6-63

| COMPONENT NAME .                   | THRUST CHAMBER                        | ASSEMBLY - 25#                         | PART NO. MAC           | 52-52'11-265                  |
|------------------------------------|---------------------------------------|--|------------------------|-------------------------------|
| NAME OF TEST                       | DURST PRESSURE                        |  | TEST NO. 208160        | 20215-61<br>2 SHET: 3550F 380 |
| 7.3.3.2.4                          | Weight Determinat                     | ion Test Data (r                       | eference parag         | raph (6)                      |
|                                    | All protective clo                    |  | red from the TC        |                               |
| •                                  | The TCA dry weight (Record to the new | t was <u>2.89</u><br>arest one-hundred | pounds.<br>ith pound). |                               |
|                                    | Inspection Remarks                    | CHANGE CONTRACTOR                      | -13-64                 |                               |
|                                    |                                       |  |                        |                               |
|                                    |                                       |  | •                      |                               |
|                                    |                                       |  |                        | •                             |
| :                                  |                                       |  |                        |                               |
|                                    |                                       |  |                        |                               |
|                                    | •                                     |  |                        |                               |
|                                    |                                       | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ |                        |                               |
|                                    |                                       |  |                        |                               |
|                                    |                                       |  |                        |                               |
|                                    |                                       |  | #\;<br>•               |                               |
| PREPARED BY DAT  E. Adams  4/10/64 | D. fawler                             | TE WITNESSED FOR NAA                   | DATE CERTIFIED         | DFOR MOONNELL DATE            |

FORM 608-B-39 NEW 6-63

| COMPONENT NAME _       | THRUST CHAMBER ASSEMBLY - 25# PART NO. \ MAC 52-52701-265  |
|------------------------|--|
| NAME OF TEST DIS       | ASSEMBLY AND INSPECTION TEST NO 208160-61 TEST NO 208160-5HEET 3560F 380   |
|                        |  |
| Reference:             | MAC SCD 52-52701, Revision F, Paragraph 6.2.3.20   |
| 7.3.4                  | Disassembly and Inspection   |
| . 7.3.4.1              | Test Procedure   |
| 7.3.4.1.1              | Prior to sectioning the TCA perform a visual inspection and record the post test condition of the TCA.   |
| 7.3.4.1.2              | Cut the propellant valve mounting bracket and propellant valve feed tubes from the TCA injector face along line A, B as shown in Figure 11. All cutting shall be done by saw.  |
| 7.3.4.1.3              | Separate the propellant valves from the mounting bracket.  |
| 7.3.4.1.4              | Section the TCA by cutting along line C-D-E as depicted in Figure 11.  |
| 7.3.4.1.5              | Perform visual inspection of all detailed parts for evidence of damage, distortion, fluid incompatability, corrosion, broken parts and impending failure.  |
| 7.3.4.1.6              | After test completion identify the sectioned TCA and detailed parts and package and store for reference (except for propellant valves).  |
| 7.3.4.1.7              | Machine, on the oxidizer propellant valve, the seat assembly to spacer weld to loosen the seat. Only the minimum amount of material to accomplish this shall be removed. The seat assembly P/N 407664 shall not be removed at this time. |
| 7.3.4.1.8              | Machine the filter assembly to solenoid weld to loosen the filter. Only the minimum amount of material to accomplish this shall be removed. The filter assembly P/N NA5-28097-17 shall not be removed at this time.                      |
| PREPARED BY:           | DATE APPROVED FOR NAA: DATE APPROVED FOR MCDONNELL: DATE   |
| R. Cole<br>CHECKED BY: | DATE   |
| 000                    | DATE / FRISL 11-30-64  |
| FORM 608-B-38 NEW      | 6-62   |

R-15019-2

 $\chi$ 

### ROCKETDYNE

### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM

|                | ·   |    |
|----------------|---|----|
| COMPONENT NAME | THRUST CHAMBER ASSEMBLY - 25# PART NO. { MAC 52-52701-265   NAA 2 3160-61 |    |
| NAME OF TEST   | ISASSFIBLY AND INSPECTION TEST NO. 208160_SHEET_OF 380                    |    |
| 7.3.4.1.9      | Remove, bag and identify the seat assembly.                               | C  |
| 7.3.4.1.10     | Remove, bag and identify the armature P/N 407569.                         | ٠. |
| 7.3.4.1.11     | Remove, bag and identify the spring P/N 406806.                           |    |
| 7.3.4.1.12     | Remove, bag and identify the filter assembly.                             |    |
| 7.3.4.1.13     | Bag and identify the solenoid assembly.                                   |    |
| 7.3.4.1.14     | Repeat 7.3.4.1.7 thru7.3.4.1.13 for the fuel propellant valve             | C  |
|                | NOTE: Only authorized personnel shall have access to stored DAT hardware. |    |

PREPARED BY: DATE APPROVED FOR NAA: DATE APPROVED FOR McDONNELL: DATE

R. Cole
CHECKED BY: DATE

11-30-64

FORM 608-8-38 NELL 6-63

FORM 608-8-38 NEW 6-63

Rev. C J. D. Maragen Date 12-1-69

# DESIGN APPROVAL TEST OF COMPONENTS FOR THE REENTRY CONTROL SYSTEM

| COMPONENT NAM   | E  |
|-----------------|--|
| NAME OF TEST _  | DISASSEMBLY AND INSPECTION TEST NO. 208160-SHEET 3570F 380   |
| 7.3.4.2         | Post Test Inspection Data - TCA #3   |
| 7.3.4.2.1       | Component Identification   |
| •               | Component Name TCA   |
|                 | McDonnell Part No. SCD52-52700-217   |
|                 | Rocketdyne Part No. 208160-61  |
|                 | Component Serial No. 4657532   |
| 7.3.4.2.2       | Preliminary Inspection ( Reference paragraph 7.3.4.1.1 )   |
|                 | The TCA was visually inspected prior to sectioning and the TCA condition was as follows: GENERAL DELAMINATION OF ESCAY HACATIVE FROM THROAT TO EXIT END.  SEVERAL DENTS IN SHELL MILLOF SHELL  EFFERIOR IS NEAT DISCOLORED NAMERATE IS DETECTED  SEVERE THERMAL EROSION OF LINERS & THROAT INSERT. |
| 7.3.4.2.3       | Disassembly and Inspection (Reference paragraph 7.3.4.1.3)   |
|                 | The TCA was sectioned along line C-D-E and visually inspected.  The results of the inspection were as follows: SEVERE THERMAL  EROSION OF FIRST THREE LINERS (AdjACENT TO THERMAL)  TOME FROMING INTO DELAMINATES CAVITICS OF ABLATIVE   |
|                 | SOME FLOWING COUNSTREAM ON THE THROAT ENSERT,  |
|                 | THROAT INSERT HIS A CIZCUMFERCUTIAL CRACK HE GATIRE THICKNESS. ABLATIVE ABESTUS, GLASS RIVING, HAS   |
| Decores and     | MULTIPLE DELAMINATIONS.  |
| E. Adams 7-     | DATE PERFORMED BY: DATE WITHESSED FOR NAA DATE CERTIFIED FOR MEDDINNELL! DATE  28-64 M. Eggy J. 74/2 J. 120  WEIFIED BY USAF:   DATE  1120 7-40 1102018  |
| FORM 608-B-43 N | IEW 6-63 & ENTERED IN WRONG BLOCK GO   |

| COMPONENT NAME  | THRUST CHAMBER ASSEMBLY -  | PART NO. MAC 52-52701-265 208160-61   |
|-----------------|--|---|
| NAME OF TEST    |  | TEST NO. 208160- SHEET 35711  |
|                 |  |   |
| 7.3.4.2.4.      | Disassembly of Propellant Valves (thru 7.3.4.1.13 .)                   | Reference Paragraphs 7.3.4.1.7 C  |
| •               | The propellant valves were disasse for were bagged and identified      |   |
| A.              | FUEL VALVE PINHO7560   | 5/N 4055173   |
|                 | ALSO O.D. OF ARMATUR  (2) BALL - IS RUSTY, SC  (3) FILTER - NO DEFECTS | ORED, CONTAMINATED . BADLY  |
|                 | (6) VALUE HOUSING - FILT<br>ON BOTTOM.<br>(6) SPRING - NO DEFECT.      | S NUTED.  |
| 汉,              |  |   |
|                 | COMPANINATED   | GALLY DISCULURED 1  |
|                 | (3) ARMATURE BALL KETA   | INER SLIGHTLY WORN  |
|                 | BRMATURE O.D. 15   | SCRATCHED& PITTED   |
|                 | (4) TELFON SEAT IS OUR   | R LAPPING INTO PORT   |
| ·               | ALSO PITTED  S FILTER - IS CONTAMING  SPRING - NO DEFECTS              | NOTED ALSO RUSTON   |
| • .             |  | Y CONTAMINATED. RUSTY +   |
| PREPARED BY C   | DATE PERFORMED BY DATE WITHESSED FOR MA                                | DATE CERTIFIED FOR MCDONNELL DATE  WAINED BY USAF  VERIFIED BY USAF  VERIFIED BY USAF  VERIFIED BY USAF  VERIFIED BY USAF  VERIFIED BY USAF  VERIFIED BY USAF  VERIFIED BY USAF  VERIFIED BY USAF  VERIFIED BY USAF  VERIFIED BY USAF |
| FORM 608-B-39 N | _ , ,  | . 765   |
|                 | 1911/1 Bate 12-1-64  |   |
| 424             | •  | R-15019-2   |

| COMPONENT NAME _ |           |          |                       |                                       | PART NO | MAC 52-52701-265        |
|------------------|-----------|----------|-----------------------|---------------------------------------|---------|-------------------------|
|                  | MINIDAL   | I INSTRU | MENTATION<br>RE TESTS | REQUIRE-                              | _       | (NAA 208160-61          |
| NAME OF TEST     | TIDITIO - | NOT LI   | us Tests              | · · · · · · · · · · · · · · · · · · · | TEST NO | ).208160 SHEET3580F 380 |

### TABLE I

|                                 |                | (3)                    | (1)                |              |
|---------------------------------|----------------|------------------------|--------------------|--------------|
| MCA CIDEMENIA                   | D.4.39975      | TODATATA!              | RESPONSE           |              |
| MEASUREMENT                     | RANGE          | PRECISION              | (SEC)              | RECORDER     |
| Main Thrust (4) (5) (6)         | 0-30 1ь        | B(+ 0.5%)              | 1 + .25            | Null Balance |
| Main Thrust (2) (5) (6)         | 0-30 1b        | YHH                    | 0.001              | Oscillograph |
| Oxidizer Inlet Pressure (4)     | 0-500 psig     | C(+ 1.0%)              | 1 + .25            | Null Balance |
| Oxidizer Inlet Pressure (4)     | 0-500 psig     | Yxx                    | 0.001              | Oscillograph |
| Fuel Inlet Pressure (4)         | 0-500 psig     | C(+ 1.0%)              | 1 + .25            | Null Balance |
| Fuel Inlet Pressure (4)         | 0-500 psig     | Y**                    | 0.001              | Oscillograph |
| Oxidizer Flowmeter Temp. (5)    | 0-300 F        | D(+ 5.0 F)             |                    | Null Balance |
| Oxidizer Inlet Temperature (5)  | 0-300 F        | D(+ 5.0 F)             |                    | Null Balance |
| Fuel Flowmeter Temperature (5)  | .0-300 F       | D( <del>*</del> 5.0 F) |                    | Null Balance |
| Fuel Inlet Temperature (5)      | 0-300 F        | D( <del>+</del> 5.0 F) |                    | Null Balance |
| Oxidizer Flowrate (5)           | 0.15-0.50 gpm  | B( <del>*</del> 0.5%)* |                    | Null Balance |
| Oxidizer Flowrate (5)           | 0-0.5 gpm      | B(+ 0.5%)*             |                    | Oscillograph |
| Fuel Flowrate (5)               | 0.15-0.65 gpm  | B(+ 0.5%)*             |                    | Null Balance |
| Fuel Flowrate (5)               | 0.0.65 gpm     | B( <del>+</del> 0.5%)* |                    | Oscillograph |
| Oxidizer Valve Current          | 0-1.0 amp      | Y                      | 0.001              | Oscillograph |
| Fuel Valve Current              | 0.10 amp       | Y                      | 0.001              | Oscillograph |
| Oxidizer Valve Voltage          | 0-40 volts     | Ynn                    | 0.001              | Oscillograph |
| Fuel Valve Voltage              | 0-40 volts     | THE                    | 0.001              | Oscillograph |
| Local Ambient Pressure          | 21-40 in Hg    | <b>T</b>               |                    | Barometer .  |
| Environmental Pressure (Fine)   | 0.02-0.20 psia |                        | 1 + .25            | Null Balance |
| Environmental Pressure (Fins)   | 0.02-0.20 psia | C(₹ 1.0%)              | 1 <del>+</del> .25 | Null Balance |
| Environmental Pressure (Coarse) | 0.02-15.0 psia | C( <del>+</del> 1.0%)  | 1 <u>+</u> •25     | Null Balance |
| Environmental Temperature       | 0-300 F        | D( 5.0 F)              |                    | Null Balance |
| Combustion Chambor Extorior     | 0-1000 F       | D (+ 20 F)             |                    | Null Balance |
| Wall Temperature (3 Places) (7) |                | · . <del>-</del> .     |                    | •            |

| 70             |          |                   |         |                         |      |
|----------------|----------|-------------------|---------|-------------------------|------|
| FREPARED BY:   | DATE     | APPROVED FOR MAA: | DATE    | APPROVED FOR MCDONNELL: | SATE |
| J. Ganger      | 9/2.9/04 | Dua               | •       |                         |      |
| CHICKED LY:    | E ME     | 1/11// -0         | 0 00 11 |                         |      |
| Kall Bring     | 15       | MOREST            | 7-67-67 |                         |      |
| FORM GOLD BULL | 30 6 62  |                   |         |                         |      |

FORM 600-B-44 NEW 6-63

EVISION A 1757 - 12 DATED 10/27/811

R Asson D/ 2752 11/2/21

R-15019-2

| COMPONENT NAME | THRUST  | CHAMBER | ASSEMBLY | 1        |          | MAC 52-52701-265         |
|----------------|---------|---------|----------|----------|----------|--------------------------|
|                | MINIMUM | INSTRU  | ENTATION | REQUIRE- | FART NO. | LNAA 208160-61           |
| NAME OF TEST   | MENTS - | HOT FIR | E TESTS  | •        | TEST NO  | . 208160 SHEET 3590F 380 |

TABLE I (cont'd)

| MEASUREMENT                             | RESPONSE<br>(SEC)             | RECORDER                                  |
|---|-------------------------------|---|
| Start and Cutoff, Pip                   | 0.001                         | Oscillograph and                          |
| Oscillograph Drive, Pip DIGR Drive, Pip | 1.0 Max<br>1.0 Max<br>1.0 Max | Time Sequence Time Sequence Time Sequence |

#### NOTES:

- (1) Response is defined as the time required for the measurement recording system to travel from zero to full scale.
- (2) Trace full scale deflection shall be 3.0 inch minimum.
- (3) Letters designate instrumentation precision category per RAO201-050.
- (4) Ranges shall be increased 100 per cent for DAT Duty Cycle to minimum duration (including Cape Cycle) and Burst Pressure Firing Tests.
- (5) A single measuring transducer may be utilized to satisfy the requirements of more than one "bit" of information under the following circumstances:
  - A) Signal of one parameter is split to satisfy the requirements for more than one type of recorder.
  - B) Transducer is physically located to satisfy the requirements of more than one parameter.
- (6) May be deleted for Cape Cycle Tests only.
- (7) May be deleted for Impulse Signal With Test only.

| PREPARED BY:  | DATE     | APPROVED FOR NAA: | DATE        | APPROVED FOR MCDONNELL: | DATE |
|---------------|----------|-------------------|-------------|-------------------------|------|
| J. Ganger     | 9/29/64  | 1110              |             |                         |      |
| CHEFALED BY   | DATE     | 11/100            | 0.0.        |                         |      |
| KW Men.       | is de    | 1/ A COURCE       | 9-29-64     |                         |      |
| FORM 608-B-38 | NEW 6-63 |                   | <del></del> | 1                       |      |

REVISION A D. Marroconis DATED 10/28/84
Revision D. D. Januar Dated 12/17/64

| COMPONE | IENT NAME THRUS'T CHAMBER ASSEMBLY PAR  | RT NO. MAC 52-52701-265   |
|---------|---|---|
| NAME OF | MINIMUM INSTRUMENTATION REQUIRE- F TEST MENTS - HOT FIRE TESTS TE   | ST NO 208160 SHEET 359 1 380  |
| NOTES:  | TABLE I (cont'd)  |   |
| *       | mBm precision is required only: 1) on the OS meters are used; 2) on the DIGR when drag body used. For drag body type flowmeters, a three shall be recorded on the oscillograph and DIGR and post test bleed flowrates: 0.032, 0.043 and deflections at nominal test flowrates shall be turbine type flowmeters, the DIGR precision si | y type flowmeters are -step transfer calibration R at the following pre nd 0.053 lb/sec. The Osc. |
| ·**     | Thrust: Perform a pre test multi-step calibration and at the following simulated thrusts: 0, 1.5, 3 24, 15, 6, 1, 1.5 and 0. This shall be followest one-step calibration (verification).   | . 6. 15. 2h. 27. 30. 27.  |
| **      | Inlet Pressures: Perform a multi-step transfer calibration (record on the oscillograph at the following in 150 and 250 psig, and test lock-up inlet pressure-step transfer calibration shall be recorded pressure.  | nlet pressures + 25 psi;  |
| **      | Valve Voltages: Perform a multi-step calibration and record of following voltages + 1 volt; 22, 30 and 26. Calibration shall be recorded at 26 + 1 volt.  | n the oscillograph at the<br>A post test one-step   |
| ***     | Perform a pre and post test Chamber Pressure : on the oscillograph.   | standardization and record  |
| ·       |   |   |

PREPARED BY: DATE APPROVED FOR NAA: . DATE APPROVED FOR MCDONNELL: 9/29/64 J. Ganger CHE LED DY DATE FORM 608-B-38 NEW 6-63

| COMPONENT NAME _ | THRUST CHAMBER ASSEMBLY | [ <b>-</b> 25# | DART NO  | MAC 52-52701-265 |                    |            |
|------------------|-------------------------|----------------|----------|------------------|--------------------|------------|
| COMPONENT HAME = | DAT DUTY CYCLE          |                |          |                  |                    |            |
| NAME OF TEST     | DAI DOIT CICLE          |                | TEST NO. | <u> 208160</u>   | -401<br>SHEET 360F | <u>380</u> |

Reference: MAC SCD 52-52701, Revision G, Sheet 101.3 & 101.4

### TABLE II

|      | Approx                  | ima <b>te</b>         |                     |                          |                      | •                                  | Accum-                      |
|------|-------------------------|-----------------------|---------------------|--------------------------|----------------------|------------------------------------|-----------------------------|
| Seq. | Phase<br>Start<br>(Sec) | Phase<br>End<br>(Sec) | Number<br>of Pulses | Pulse<br>Period<br>(Sec) | Pulse Duration (Sec) | Operating<br>Time Per<br>TCA (Sec) | Firing<br>Time<br>(Sec) (1) |
| 1    | 0                       | 15                    | 36                  | 0.417                    | 0.031                | 1.116                              | 17.116                      |
| 2    | 15                      | 24                    | 1                   |                          | 4.20                 | 4.2                                | 21,316                      |
| 3    | 24                      | 30                    | 4                   | 1.50                     | 0.690                | 2.76                               | 24.076                      |
| 4    | 30                      | 11,034                | <b>27</b>           | 407.                     | 0.014                | 0.378                              | 24.454                      |
| 5    | 11,034                  | 11,040                | 4                   | 1.50                     | 0,690                | 2.76                               | 27.214                      |
| 6    | 11,040                  | 11,300                | <b>27</b> .         | 9.65                     | 0.020                | 0.54                               | 27.754                      |
| 7    | 11,300                  | 12,186                | 168                 | 5.27                     | 0.031                | 5.208                              | 32.962                      |
| 8    | 12,186                  | 12,237                | 8                   | 6.38                     | 0.690                | 5.52                               | 38.482                      |
| 9    | 12,240                  | .12,244               | 4                   | 1.00                     | 0.029                | 0.116                              | 38.598                      |
| 10   | 12,246                  | 12,330                | 544                 | . 0.15 2                 | 0.053                | 28.938.                            | 67.536                      |
| 11   | 12,361                  | 12,377                | . 18                | 0.889                    | 0.031                | 0.558                              | 68-094                      |
| . 12 | 12,377                  | 12,436                | 41                  | 1.440                    | 0.029                | 1.179                              | 69.273                      |
| 13   | 12,436                  | 12,447                | 3 <b>3</b>          | 0.333                    | 0.031                | 1.023                              | 70.2%                       |
| 14   | 12,478                  | 12,489                | 12                  | 0.916                    | 0.029                | 0.348                              | 70.644                      |
| 15   | 12,489                  | 12,571                | 8                   | 10.25                    | 0.690                | 5.52                               | 76.164                      |
| 16   | 12,574                  | 12,675                | 93                  | 1.09                     | 0.029                | 2.727                              | 78.891                      |
| 17   | 12,705                  | 12,756                | 336                 | 0.152                    | 0.053                | 17.808                             | 96.699                      |
| 18   | 12,761                  | 12,794                | 37                  | 0.892                    | 0.029                | 1.073                              | 97.772                      |
| 19   | 12,7%                   | 12,805                | 70 <sup>.</sup>     | 0.129                    | 0.03                 | 3.710                              | 101.482                     |
| 20   | 12,815                  | 12,857                | 35                  | 1.20                     | 0.029                | 1.015                              | 102.497                     |

|                    |         |                      |           | <del></del>             |      |
|--------------------|---------|----------------------|-----------|-------------------------|------|
| PREPARED BY: 10.15 | / DATE  | APPROVED FOR NAA:    | DATE      | APPROVED FOR MCDONNELL: | DATE |
| E. Adams 1 Ey      |         |                      | 5.11.2    |                         | 04.6 |
| -                  | 4/10/64 | <b>1</b> 0. <b>4</b> | ,         |                         | ,    |
| CHECKED BY:        | DATE    | 11016                | 11 12 411 |                         |      |
| 2/2/11/            | -       | 15/1/10/10/19        | 4-13-64   |                         |      |
| 1/4 Vilonde        | 2/13/54 | A COUNTY COMME       | • •       |                         | •    |
| FARL CAD           |         |                      |           | !=C                     |      |

FORM 608-3-38 NEW 6-63

| COMPONENT NAME _ | THRUST CHAMBER ASSEMBLY | - 25# PART NO | MAC 52-52701-265<br>NAA 208160-61         |
|------------------|-------------------------|---------------|---|
| NAME OF TEST     | DAT DUTY CYCLE          |               | 1 NAA 208160-61<br>208160-8HEET 3610F 380 |
| MAINE OF TEST    |                         |               |   |

#### TABLE II (CONTINUED)

|            | Approx                  | ximate                |                     |                          |                      | •                            | Accum                       |
|------------|-------------------------|-----------------------|---------------------|--------------------------|----------------------|------------------------------|-----------------------------|
| Seq.       | Phase<br>Start<br>(Sec) | Phase<br>End<br>(Sec) | Number<br>of Pulses | Pulse<br>Period<br>(Sec) | Pulse Duration (Sec) | Operating Time Per TCA (Sec) | Firing<br>Time<br>(Sec) (1) |
| 21         | 12,874                  | 12,893                | 140                 | 0.135                    | 0.053                | 7.42                         | 109.917.                    |
| 22         | 12,898                  | 12,918                | · 23                | 0.870                    | 0.029                | 0.667                        | 110.584                     |
| 23         | 12,919                  | 12,996                | 8                   | 9.62                     | 0.690                | 5.52                         | 116.104                     |
| 24         | 12,998                  | 13,042                | 52                  | 0.845                    | 0.029                | 1.508                        | 117.612                     |
| 25         | 13,062                  | 13,063                | 8                   | 0.125                    | 0.053                | 0.424                        | 118.036 (2)                 |
| 26         | 13,064                  | 13,150                | 314                 | 0.274                    | 0.053                | 16.642                       | 134.678                     |
| 27         | 13,190                  | 13,222                | 36                  | 0.890                    | 0.029                | 1.044                        | 135.722                     |
| 28         | 13,262                  | 13,267                | 6                   | 0.833                    | 0.031                | 0.186                        | 135.908                     |
| 29         | 13,267                  | 13,289                | 25                  | 0.880                    | 0.029                | 0.725                        | 136.663                     |
| <b>3</b> 0 | 13,324                  | 13,473                | 441                 | 0.338                    | 0.053                | 23.371                       | 160.004 (3)                 |

#### NOTES:

- (1) Includes ten (10) seconds calibration firing and six (6) seconds of simulated cape checkout.
- (2) The TCA shall demonstrate specification performance for an accumulated firing time, including calibration and simulated cape firings of 118 seconds. TCA skin temperature shall not exceed 550 °F.
- (3) The TCA shall demonstrate operation without catastrophic failure for an accumulative firing time of 160 seconds.
- (4) Tests to failure will be conducted by repeating the pulses subsequent to 118 seconds within specification to 160 seconds until failure occurs.

| -   |             | o o o o o o o o o o o o o o o o o o o |                   |         |                                       |      |
|-----|-------------|---------------------------------------|-------------------|---------|---------------------------------------|------|
| P   | REPARED BY: | DATE                                  | APPROVED FOR NAA: | DATE    | APPROYED FOR MCDONNELL:               | DATE |
| I   | E. Adams    | 7-10-64                               | 2000-             |         |                                       |      |
| C   | HECKED BA:  | DATE                                  | 56 3000           | 8-4-64  |                                       |      |
|     | of Jones    | 8-5-64                                | the A filter of   | V / - / |                                       |      |
| _ : | (-0(        | 1                                     |                   |         | · · · · · · · · · · · · · · · · · · · |      |

FORM 608-B-38 NEW 6-63

|              | •              | # PART NO. \( \begin{aligned} \text{MAC} & \frac{52-52701-265}{208160-61} \\ \text{MAA} & \frac{208160-61}{208160-401} \\ \text{SHEET} \frac{362}{208160-401} \\ \text{SHEET} |
|--------------|----------------|---|
| NAME OF TEST | DAT DUTY CYCLE | TEST NO. SALE TEST NO.  |

#### TABLE II

NOTES: (cont'd)

- (4) Catastrophic chamber failure is defined as a condition in which further operation of the TCA would endanger the space craft or crew. Specifically it shall include:
  - (a) Loss of the capability to stop propellant flow,
  - (b) Any flow or leakage of propellants products of combustion at locations other than the TCA nozzel exit,
  - (c) Temperature in excess of 700 F at any point on the TCA exterior wall.

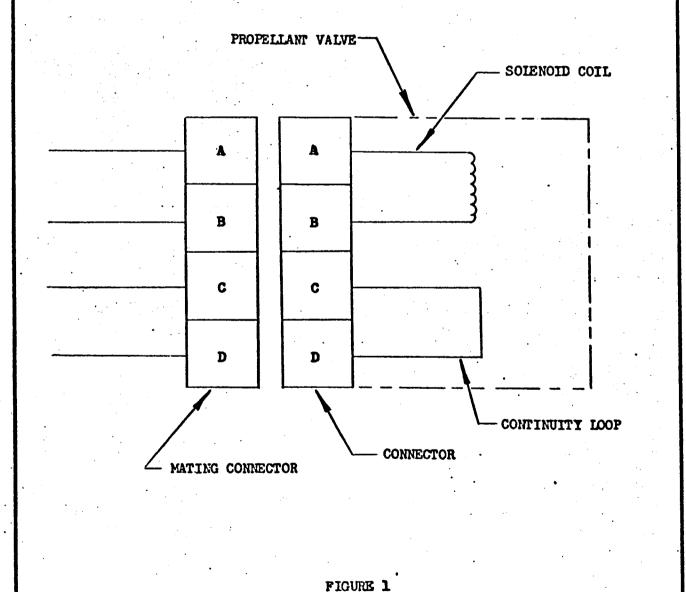
#### NOTE:

Three temperature sensors shall be mounted on the exterior wall as shown in Figure 6. The average temperature is to be used only when 700 F is not exceed by the TCA.

| PREPARED BY: | - /   | DATE  | APPROVED FOR NAA | : DATE   | APPROVED FOR MCDONNELL: | DATE |
|--------------|-------|-------|------------------|----------|-------------------------|------|
| E. Adams     | EA 4  | 10/64 |                  | •        |                         |      |
| CHECKED BY:  |       | DATE  | MARIO.           | 11 17-14 |                         |      |
| 21/11/201    | ! "   | 1/1   | Moire            | 4-12-64  |                         |      |
| 7/11/1000    | e- 0/ | 1164  |                  |          |                         |      |

FORM 608-B-38 NEW 6-63

COMPONENT NAME THRUST CHAMBER ASSEMBLY = 25# PART NO. \[
\begin{array}{c}
\text{MAC} \frac{52-52701-265}{208160-61}
\end{array}
\text{NAME OF TEST PROPELLANT VALVE ELECTRICAL SCHEMATIC TEST NO. \( \frac{208160-61}{208160-101} \)
\text{NAME OF TEST PROPELLANT VALVE ELECTRICAL SCHEMATIC TEST NO. \( \frac{208160-61}{208160-101} \)
\text{NAME OF TEST PROPELLANT VALVE ELECTRICAL SCHEMATIC TEST NO. \( \frac{208160-61}{208160-101} \)
\text{NAME OF TEST PROPERTY NO. \( \frac{1}{208160-101} \)
\text{NAME OF TEST NO. \( \frac{1}{208160-101} \)
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COMPONENT NAME THRUST CHAMBER ASSEMBLY - 25# PART NO. 

PROPELLANT VALVE PROOF PRESSURE

NAME OF TEST AND LEAKAGE

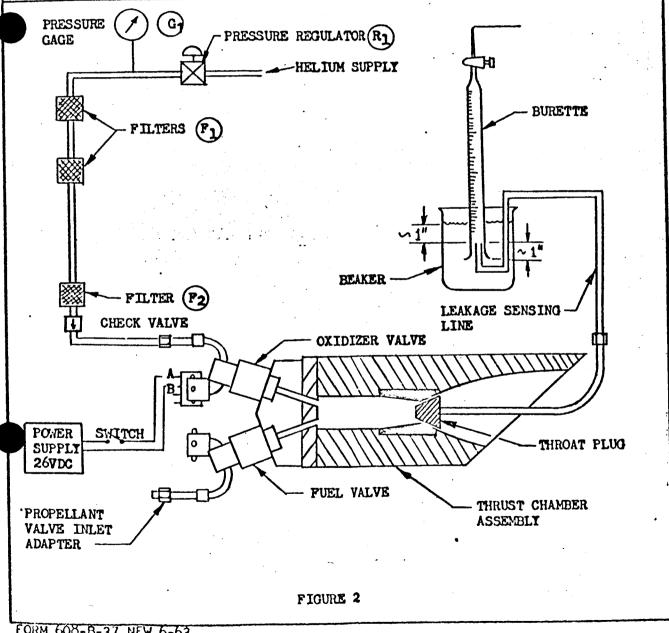
TEST NO. 203160-101

TEST NO. 203160-101

TEST NO. 203160-101

TEST NO. 203160-101

TEST NO. 203160-101



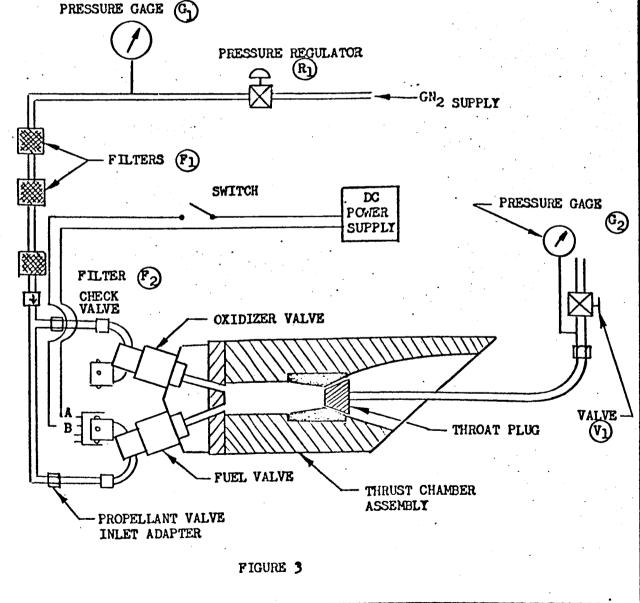
FORM 608-8-37 NEW 6-63

COMPONENT NAME THRUST CHAMBER ASSEMBLY- 25# PART NO. MAC 52-52701-265

THRUST CHAMBER PROOF PRESSURE

NAME OF TEST AND LEAKAGE

TEST NO. 208160-401
SHEET 370 F 380



FORM 608-B-37 NEW 6-63

MAC 52-52701-265 COMPONENT NAME \_\_THRUST CHAMBER ASSEMBLY-25# \_ PART NO. NAA 208160-61 TEST NO 208160- SHEET 3710F 380 NAME OF TEST PROPELLANT VALVE FUNCTIONAL . Voltage trace (closing time) - CURRENT TRACE (OPENING TIME) OSCILLOSCOPE and POLAROID CAMERA DC POWER SUPPLY PRESSURE REGULATOR (R1) **VOLTMETER** MERCURY SWITCH TRIGGER SUPPLY RESISTOR (0.1 ohm) PRESSURE CURRENT TRACE LEAD GAGE (G) VOLTAGE TRACE LEAD ZENER 本 DIODE FILTER DIODE OXIDIZER VALVE THRUST CHAMBER ASSEMBLY PROPELLANT -VALVE INLET ADAPTER FUEL VALVE FIGURE 4

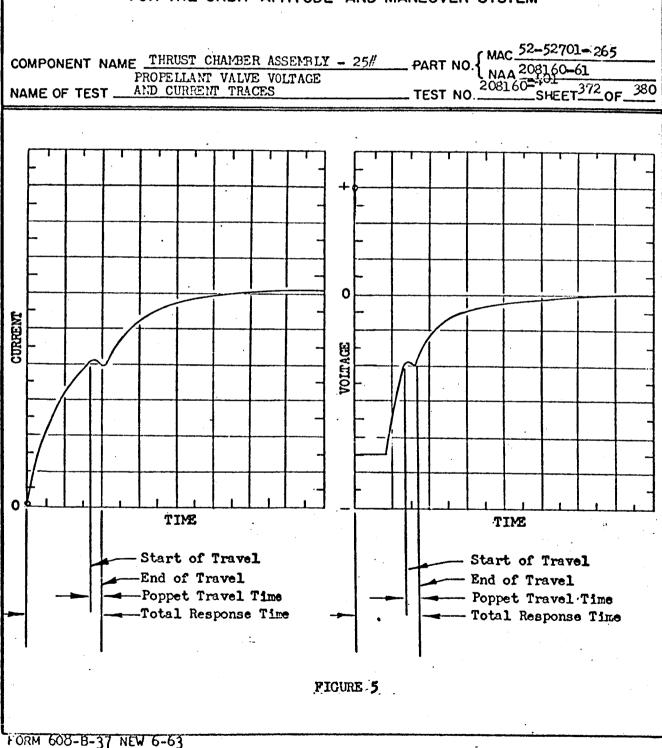
434

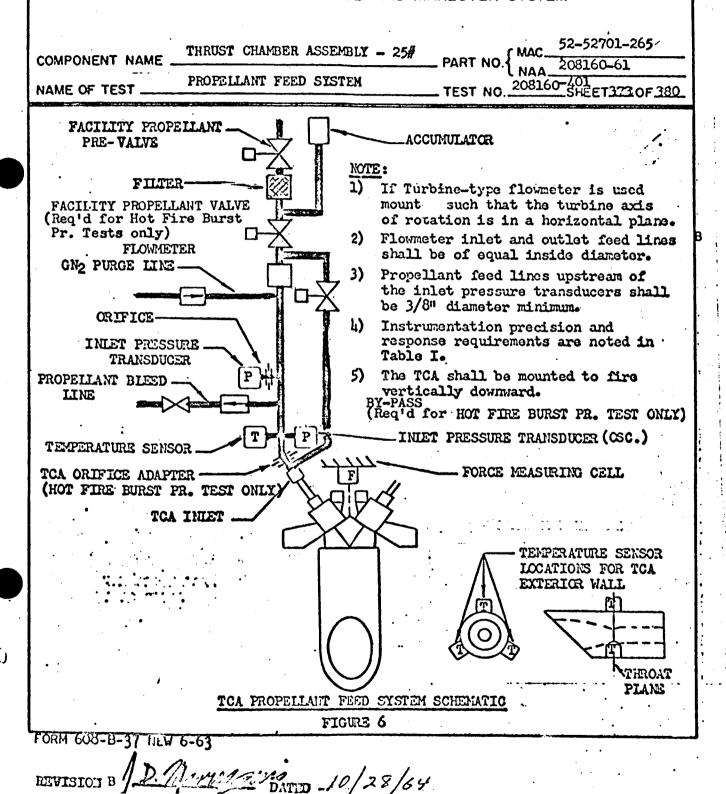
FORM 608-B-3/ NEW 6-63

### ROCKETUYNE

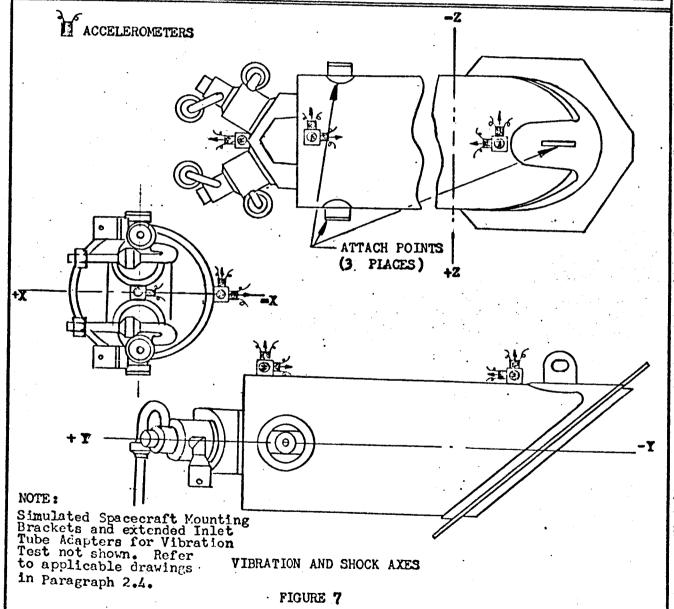
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### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM





R-15019-2

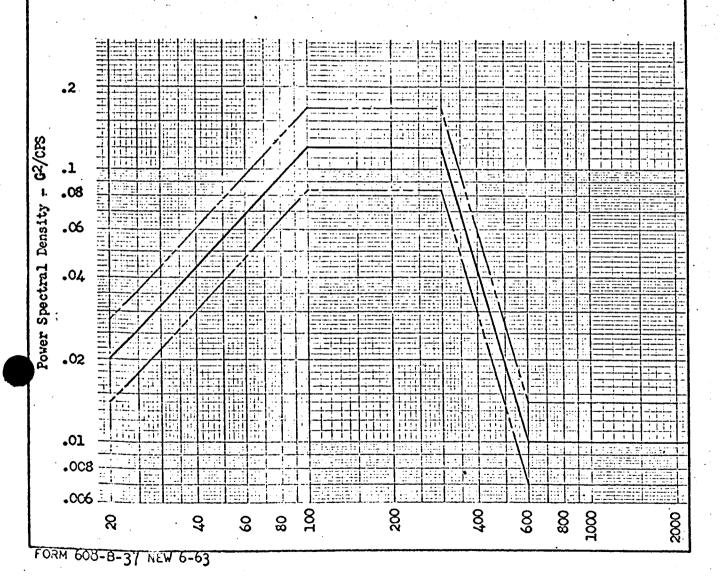


FORM 608-B-37 NEW 6-63

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FREQUENCY - CPS

| COMPONENT NAME    | THRUST CHAMBER   | ASSEMBLY-25#     | PART N | IO. { MAC 52-52701- | 265 |
|-------------------|------------------|------------------|--------|---------------------|-----|
| NAME OF TEST PROP | ELLANT VALVE ELE | CTRICAL RESISTAN |        |                     |     |

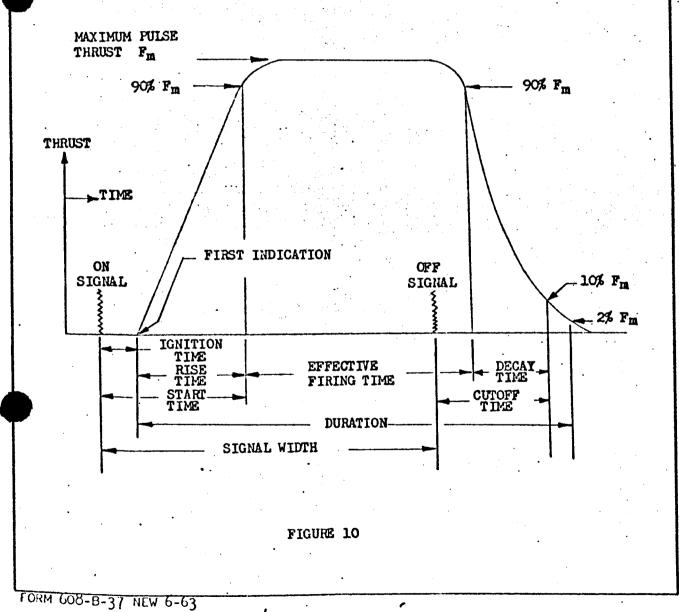
|   |                      |    |     | •   |     |      | -   |            |                      |      |                  | ,,,,  |                            | _    |      |      | _   |      |               |       |      | _    |              |      |      |                |      |                      |          |      |                | -    |       |      |                 |      |       |       |                 |     |                 |                 |       | -   |      |               |
|---|----------------------|----|-----|-----|-----|------|-----|------------|----------------------|------|------------------|---|----------------------------|------|------|------|-----|------|---------------|-------|------|------|--------------|------|------|----------------|------|----------------------|----------|------|----------------|------|-------|------|-----------------|------|-------|-------|-----------------|-----|-----------------|-----------------|-------|-----|------|---------------|
|   |                      |    | III |     |     | Ж    |     | H          |                      |      | 1                |   |                            |      |      | 1    |     | Ш    |               |       |      | H    |              | 1111 |      | Ш              |      |                      |          | 11!! | Ш              |      |       | III  | Ш               | III  | 11:1  |       |                 |     | Ш               | Hi              | Ш     | Ш   | Hi   | 111           |
|   |                      |    | li  | H   |     |      | :   | H          |                      |      |                  |   |                            |      |      | liil | H   | Ш    |               | 1111  |      | ili  |              | Hi   | 1!!  | til:           |      |                      |          | ##   | 1              | 1111 | 11:   | lili | ₩               | HH   | ###   |       |                 |     |                 | H÷              | ##    | Н   | ##   | Ш             |
|   | Ш                    | Н  | -   | H   |     | Ш    | -   | Ш          | Ш                    | -  - | !::              | Ш   |                            | **   | ***  | Ш    | ₩   | !!:  | <b></b>       | Ш     | !:   | Щi   |              | Щ    | 1:1  | Ш              | Ш    |                      | 1111     | :  ; | Ш              | Ш    | Ш     | Щ    | Ш               | Ш    |       |       | Ш               | Ш   | Ш               |                 |       | Ш   | Ш    | Ш             |
|   | Hil                  | Ш  | !!! | Ш   |     |      |     | H          | Hiii                 | :    | 1;:              |   | ii                         |      | 1    | liii | Ш   | ###  |               | Ш     |      | Hi   |              | !!!! |      |                |      |                      | lili     |      | !!!            |      |       | lili | Ш               |      | 111   | Ш     | Ш               | Ш   | П               | Ш               | 111   | Ш   | Hi   | П             |
|   | Ш                    |    | H   | i   |     | H    |     | 111        | []]                  | !];  |                  | Ш   |                            | Ш    | 111  | П    | III | Ш    | Ш             | liii  |      | #    |              | 111  | 111  |                | ili  | 1::11                |          | ###  | Ш              |      |       | 11:1 | ###             | Ш    | 1::   | ::::  | Ш               |     |                 |                 | Ш     | Ш   |      | Ш             |
|   | Ш                    | Н  | H   | Ш   | Н   | Ħ    |     | ##         | <del>         </del> | H    | <del>     </del> |   | Н                          |      | 1    | 1::: | ##  | ***  |               | 1#    |      | ##   | :::!         | ##   | ##   | ::::           |      | <del>         </del> | 1        | -111 | Ш              |      |       | Ш    | <del>!!!!</del> | H    | !!!!  |       | Ш               | Ш   | Ш               | Ш               | Ш     | Ш   | Ш    | Ш             |
|   | Ш                    | Щ  | Ш   | Ш   | Ш   | Щ    |     | ###        | <b>!</b> !!;         | 4    | 111              |   |                            | ш    | Ш    | ш    | Щ   | 111  | Ш             | Ш     |      | Ш    | Ш            |      |      | Ш              |      |                      |          | Hii  | !il            | Ш    |       | Ш    | Ш               | Ш    | H     | Ш     | Ш               |     |                 |                 |       | Ш   | Ш    | Ш             |
|   | Ш                    | Ш  | iii | Ш   | Ш   | H    |     | 111        | Hiil                 |      |                  |   |                            |      | lii! |      | Ш   | Hiii |               | Ш     |      | Ш    | Ш            |      | Ш    | !!             | Ш    |                      |          | !!!! |                |      |       | IIII | Ш               | Ш    |       |       | Ш               |     |                 |                 | Ш     | Ш   |      | Ш             |
|   | Ш                    |    | III | П   | ii  |      |     |            | liii                 | ili  |                  | Ш   | li                         |      |      |      | ili | 11:  |               | 1111  |      | :::  |              | ##   | 1    | ::::           |      |                      | 111      |      | **             |      |       | 1::: | ₩               | ###  | H     |       |                 | Ш   |                 | Hi              | ##    | Ш   | ##   | ₩             |
|   | Ш                    | Ш  | #   | Н   | #   |      |     | 11:        | 1                    |      |                  |   |                            |      |      | 14   |     | Ш    |               | 11:1  | ##   | ₩    |              | ##   | 111  | Ш              |      | H                    |          | ##   |                |      |       | 1    | ###             | Ш    | -     | :::   |                 |     | Ш               | Ш               | 111   |     | Ш    | Ш             |
|   | Щ                    | Ш  | Ш   | Ш   | Ш   | Ш    |     |            | Ш                    | Ш    |                  |   | Ш                          |      | Ш    | 111  | Ш   | 111  |               | Ш     |      | !!!  | Ш            | !;!  | Ш    |                |      | li:                  | Ш        |      | 111            |      |       | 1111 | 1111            |      |       |       |                 | Ш   | Ш               |                 |       | Ш   | Ш    | Ш             |
|   |                      | Н  |     |     | H   | Н    |     |            | Ш                    |      |                  | Ш   | H                          |      |      |      | ##  |      |               | 1:::  | 111  | #    |              | !;;  |      | !:             | :::: |                      |          |      | :              |      |       | Tiil | 1111            | Ш    | 111   |       |                 |     | Ш               |                 | Ш     | Ш   |      | Ш             |
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|   | Ш                    |    | Ш   |     | Ш   |      |     |            | Ш                    |      | !!!              |   |                            | Ш    | !!!! |      | Ш   |      |               | Ш     |      | 1    | Ш            | Ш    |      |                |      |                      |          | illi | #              |      |       | Hill | Ш               |      | 144   |       |                 |     |                 |                 | Ш     | H   | III  | Ш             |
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|   |                      | Ш  | Щ   | Н   | Ш   | Н    |     | Ш          | Ш                    |      | :::              |   | Ш                          | Ш    | ##   | 111  | 4   | 111  | Ш             | 1:::  |      | #    | !!!          | Ш    | Ш    | !!!            | Щ    |                      | Ш        |      | Ш              | Ш    |       | Ш    | 1               | ::11 |       |       |                 | Ш   |                 | ij.             | аll   | Ш   |      | Ш             |
|   | Ш                    | Ш  |     | Ш   | 11  |      |     | 1          | 1::                  |      | :::              |   | Ш                          |      | H    |      | !!! | !!!  |               | III   |      | Ш    |              |      |      | Ш              | iii  |                      | L.       |      | :::            |      |       | H    | HH              | Ш    | Н     |       | 111             | ::: |                 | :               | 1     | Ш   | Ш    | Ш             |
|   | Ш                    |    | ::  | Н   | Ш   | H    |     | R:         | riii                 |      | 111              | m   | П                          |      | 111  |      |     | ii.  |               |       |      | 11   | ==           | 4    |      | 11             |      | 1                    | I        |      | =              |      | 1111  |      | 111             | Ш    |       |       |                 |     | 11.             | 1117            | 111   | Ш   | #    | W             |
|   | ***                  | H  | ##  |     | #   | ä    |     | ##         | ##                   |      | ##               |   | Н                          | ш    | ##   | ٤    | #   | بنبا |               | 1     | 1    | ##   | ##           | :::: | ##   | Ш              |      |                      | Ш        |      | Ш              |      | Ш     | 111  | Ш               |      |       |       |                 | Ш   | ( <u>)</u> (j.  | 44              | ШĖ    | 11  | 범립   | 4             |
|   | Ш                    | Ш  | #   |     | i:t | ш    | Ш   | Ų::        | 111                  |      | :::              | 1111  | Г                          |      | III  | 1    | 111 | 111  |               |       |      | Щ    | Ш            | ili  | Ш    | Ш              |      |                      | Ш        |      |                |      |       | liii | Ш               | Ш    | Hi    |       | Ш               | •   | 1.1             | ι <del>ή</del>  | 11    | ffi | 1    | i#            |
|   | Ш                    | Ш  | H   |     | :   |      |     |            |                      |      | 11:              |   |                            |      |      |      |     | ii!  |               | iii   |      | :  : | :::1         |      |      |                |      |                      |          |      |                |      |       |      | Hil             | Ш    |       |       | 3               | 1   |                 | 1               |       | !!! | Ш    | Ш             |
|   | Ш                    |    | Ш   | i,  | Ĺ   |      |     | Ш          |                      |      |                  |   | П                          | Ш    |      |      |     |      |               |       |      |      |              | 111  |      | 1:1:           | :::: |                      |          |      | !::            | **   | -     | 111  | 111             | Ħ    |       | ш     | 111             |     | ***             | Ш               | ilit  | !!! | Hi   | ₩             |
|   | #                    | H  |     |     | 14  | -    |     |            | i ii                 | -    | 111              | 111   |                            |      | 170  | -    |     |      |               |       |      | #    | ##           |      | Щ    | ₩              | ÷    |                      | 4        | -    | ₩              | Ш    |       | -    | Ш               | Ш    | Ш     | !!;   |                 | Ш   | 144             | !!!:            | Ш     |     |      | Ш             |
|   | Ш                    | Ш  | Ш   |     |     | Ш    | Щ   | H          |                      |      |                  |   |                            |      |      |      | Ш   |      |               | -<    | t    | 11   |              | įi:  |      | Ш              |      |                      |          |      | ::1            | ::!; | Ш     |      | ###             | Ш    |       | 111   |                 | Щ   |                 |                 | Ш     | Ш   |      | H             |
|   | Ш                    | H  | Ш   |     | -   |      |     |            | !!!!                 |      |                  |   | ÷                          |      | ***  |      | H   |      |               | H     |      | ₩    | ш            | 2    | М    | E              | A    | li:I                 |          | 1    | 111            | Al.  | Ċ.    | 4    | <i>u:;</i>      |      | Н     | Ш     |                 |     | 111             | 1112            | 111   |     | Ш    | ${\mathbb H}$ |
|   | Hi                   | Ħ  |     | T   | į   |      |     | Ĭ          | 111                  |      | 11:              |   | 1                          |      |      |      | ii  | 11:  | 1             |       |      | :    | 111          | ijĪ  |      | 11             |      |                      |          |      |                |      |       |      |                 | ŦĦ   | Ж     |       | Hi              |     | #               | Hii             | :   = | H   |      | ##            |
|   | ##                   | #  |     | 4.  |     |      |     | Ш          | Ш                    |      |                  |   |                            |      |      | Ш    | Ш   | Hi   |               | Hii   | Ш    | Ш    | :::          | 111  |      | H              |      |                      | Ш        |      | **             | 1111 |       | 1111 | -114            | H    | -     |       | Ш               | Ш   |                 | Ш               | Ш     | Ш   | Щ    | Ш             |
|   | Ш                    | П  | Ш   |     |     |      |     | 1          |                      |      | lii:             |   |                            | Ш    |      |      | H   |      |               |       |      | Ш    | Ш            |      |      | 1:1            | ш    | نننا                 | 4-       |      | ::1            |      |       |      |                 | !!!! | Ш     |       | Ш               | Ш   | Ш               | Ш               |       | Ш   | Ш    | Ш             |
|   | Hit                  | il |     | Ė   | ::i | !!!  | Щ   | Ш          | lili                 |      |                  |   |                            | Ш    | •!:  |      | Ш   |      | !!!!          | 11111 |      | 1    | ***          | 111  |      | П              |      |                      |          |      | ::1            | :::: |       | Ш    | !!!             | Ш    | Ш     |       |                 | ill | III             | IIIi            | Ш     | Ш   | Ш    | Ħ             |
|   | Ш                    | Ħ  |     |     | Ħ   | i    |     |            | 1:::                 |      | i                | :::   |                            |      |      |      |     | +    | 1             | 1:11  |      | #    | !!!!         |      | Ш    | Ħ              | Ш    |                      |          |      | 111            |      | Hi    | 111  | ##              | ##   | ж     |       | ##              | ##  | <del>    </del> | <del>    </del> | :     | :#  | Ш    | ##            |
| G Z G Z G Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z   | $\parallel\parallel$ | H  | H   | H   | ₩   | Ш    |     |            | H                    |      | <u> </u>         | <b>!</b> !!!                                      |                            |      | ##   | 4#   | Ш   | ##   | Щ             | 1111  | Ш    | :  : | Ш            | ##   | 111  | !!             | Ш    | 11:11                | 111      | 111  | 44             | Ш    |       | Ш    | ##              | :    |       | 14    | Ш               | Ш   | Ш               | Ш               | :[[]  | Ш   | Щ    | Ш             |
| G Z G Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z   | Ш                    | Ш  |     | li  | Ш   | lii: |     |            |                      |      |                  | 1111  |                            | Ш    | !!!  |      | Ш   |      | Ш             |       |      | H    | Ш            |      |      | Ш              |      | Hii                  |          | 11   |                |      |       | 111  | 11!!            |      |       |       | Ш               | !!! | 1111            | Ш               |       | 111 | Ш    | H             |
| G Z G G Z G G G G G G G G G G G G G G G   |                      | iŧ |     |     | Ħ   | i!   |     |            |                      |      | !!!!             |   |                            | 111  | H    |      |     | HI.  | iII,          |       |      | il;  | Ш            |      |      | iil            |      |                      |          |      |                | Ш    |       |      |                 | Ш    |       |       | Ш               | Ш   | Ш               | Hii             | Ш     |     | Ш    | 1             |
|   | Ш                    | H  | #   |     | H   | iii  |     |            | ##                   |      |                  | <del>                                      </del> | #                          | ***  | ***  | -    |     | ***  | ╫             | 1     | -    | H    | ***          | ***  | #    | <del>iil</del> | H    | 1                    | -        |      | ***            | ::!! | -     | -11: | -               |      |       |       | ##              | #   | <u> </u>        | <del>   :</del> | ::::  | +++ | :::: | -             |
| SACRETT (17 SETURE SECTION 75 SACRETURE)  | 卌                    | #  | #   | 4   | Ш   | H    | Ш   |            |                      |      | Щ                | Hii   | $(\frac{1}{4}\hat{\omega}$ | Щ    |      |      | Ш   | il.  | <u>'</u> ;::: |       |      | Щ.   | 68           | ili  | 111  | 1:-            | Щ    | 11:5                 | <b>/</b> | ЩЦ   | H              | 捌    | liiz. | 1    | Ш               | 411  | Ш     | Ш     | Įξ              | Ш   | Ш               | Ш               | Ш     | Ш   | Ш    |               |
| SACRET VI SELVE LINESSE VOE 72 MARINETUR.   | Ш                    | 1  |     |     | H   | 1    |     | i          |                      |      | 1                |   |                            |      |      |      |     |      | liii          | Hili  |      | :1   | -            | 77   | Ġ    | ij             | -;;  |                      | i, i     |      | Ш              |      |       | Ш    |                 |      |       |       | ]]];            | Ш   | <b> </b>        | Ш               |       |     |      | H             |
| E POR LE L'AL SEL LE L'EXPESSE DE L'EXPESSE | Ш                    | I  |     |     | 111 | III  |     |            | 111                  |      | III              | IIII  |                            | III  |      |      |     | III  | 1111          |       |      |      | 111          | II   |      | Щ              |      | 1111                 | ilit     |      |                | iili | Ш     |      |                 | Ħ    |       | Ш     | Ш               | #   | Ш               | tii:            | :#    | Ш   | HH   | #             |
|   | H                    | H  | H   | H   | Ш   | H    | H   |            | III                  | H    |                  | <del>         </del>                              | H÷                         | ##   | :::  | Hi   | ::: | !!!  | 1             |       |      | :4;  | :::          |      |      | Щ              | -11  | 144                  | Ш        | Щ    |                | Ш    | Щi    | 111  |                 | Ш    | Щ     | ;;;   | <del>   !</del> | ₩   | Ш               |                 | Ш     | Ш   | Ш    | 1             |
|   | Ш                    | 1  | Ш   | ij. | Щ   | ш    | Щ   |            | Ш                    | Ш    | Ш                | Ш   | !li                        | Ш    | 11!  | lli. | 11  | ίĿ   | 1111          | 10    |      | 1    | ##           | 111  |      | 111            |      |                      | Ш        |      | Ш              | 7.7  | III.  |      | 11.             | 111  |       |       | Ш               | Ш   | Ш               | Ш               | Ш     | Ш   | Ш    | 1             |
|   | $\mathbb{H}$         | H  |     |     | Ш   | Hi   | Ш   |            | Ш                    |      | Ш                | Hiii  |                            |      |      | lli  |     |      | !!            |       |      |      | iii          |      |      | ill            |      | Hiii                 | Hili     |      |                | Ш    | lili: |      |                 | Ш    |       | Ш     | Ш               | 1   | $\prod$         | Ш               | $\Pi$ |     | Ш    | IF            |
|   |                      | il |     |     | Ш   |      | lit |            | Hii                  |      |                  | Hii   |                            | iiil | HI   |      |     |      | Hii           |       | 15   |      | اند.<br>نا   | 144  | ili' |                | 1    | 1111                 | 11       |      |                | ##   | Ш     |      |                 | ill  | lili: | t:::I | 11:1            | ##  | ĦĦ              |                 | :11   | Ш   | ###  | #             |
|   | #!                   | 1  | Ш   |     | H   | Ш    |     | Ш          | Ш                    |      | III.             |   |                            |      | ##   | 111  |     |      | ₩             | Ш     | 4    | -):  | H            | ++   | Ш    | ::1            | :#   | 1111                 | #        | Ш    | Щ              | Ш    | Щ     | -}   | Щ               | Щ    | Ш     | 1111  | 114             | 1   | Ш               | Ш               | 111   | Ш   | Щ    | Ш             |
|   | Ш                    | !! |     | 1   | H   | Щ    |     |            |                      |      |                  |   |                            |      |      |      |     | Ш    |               | Ш     |      |      |              |      |      |                |      | liii                 |          |      |                | Ш    | Ш     |      |                 |      | Ш     | Ш     | HII             |     | Ш               |                 | Ш     |     |      |               |
|   | HH                   | 11 | 11  | 11  | Щ   |      |     |            |                      |      | Ħ                | 1111  | !!!                        |      |      |      |     |      | Hii           | Ш     |      |      | 1(i)<br>:ii: | Ш    |      | Ш              |      |                      | Ш        |      |                | H    | IIIi  |      |                 | III  |       | IIII  | 1111            |     | IIII            | IIII            | :!!   |     |      |               |

10.1.1 600-0-37 1.211 6-63

R-15019-2.

### ROCKETDYNE

### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM



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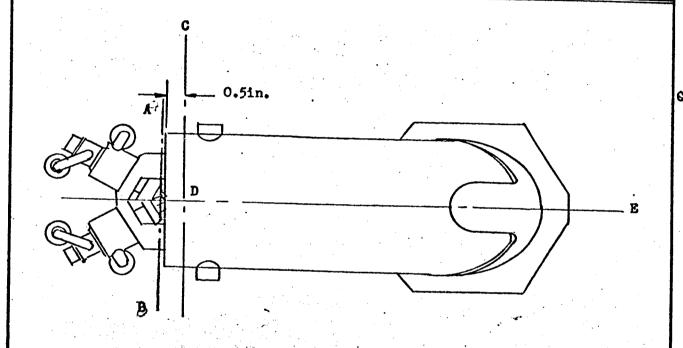
REVISION A.D. Mary Dated 7-29-64

COMPONENT NAME THRUST CHAMBER ASSEMBLY -25# PART NO. \{ MAC \frac{52-52701-265}{NAA \frac{208160-61}{200}} \]

NAME OF TEST DISASSEMBLY AND INSPECTION TEST NO. \( \frac{208160-51}{200} \)

TEST NO. \( \frac{208160-51}{200} \)

TEST NO. \( \frac{208160-51}{200} \)



SECTIONING DIAGRAM

FIGURE 11

FORM 608-B-37 NEW 6-63

Rev. C. D. Morroson Vate 11-20-69

 $\dot{p}_{\vec{k}}$ 

CSCILLOSCOPE DC PCWER SUPPLY SWITCH XH VALVE (19) CONNECT POINT-(INLET ADAPTER) FILTERS (F1 THERMOCOUPLE OUTLET ADAPTER INLET ADAPTER (P/N 99-106040) CONNECT POINT DISCHARGE TEMPERATURE CHAMBER TEMPERATURE READOUT. FIGURE 12

FORM 608-0-37 NEW 6-63

### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM MAC\_52-52701-265 THRUST CHAMBER ASSEMBLY - 25# PART NO. COMPONENT NAME . NAA 208160-61 EXPLOSIVE ATMOSPHERE TEST NO. 208160-SHEET 380 0F380 NAME OF TEST \_ DC POWER SUPPLY : EXPLOSION PROOF TESTING CHAMBER TEMPERATURE SWITCH READOUT SWITCH SPARK EXCITER THERMOCOUPLE PROPELLANT VALVE COMBUSTION OUTLET ADAPTER (P/N 99-106040) SAMPLING CHAMBER EXPLOSIVE EXPLOSION CHAMBER MIXTURE SUPPLY EVACUATION SYSTEM

FIGURE 13

FORM 608-B-37 NEW 6-63

R-15019-2

### DESIGN APPROVAL TEST OF COMPONENTS FOR THE ORBIT ATTITUDE AND MANEUVER SYSTEM MAC 52-52701-265 THRUST CHAMBER ASSEMBLY - 25# COMPONENT NAME D NAME OF TEST \_ PROPELLANT VALVE LOAD ANALYSTS PROP. VALVE TEST PANEL MILL-POWER VOLTMETER AMMETER AMMETER SUPPLY OSCILLOGRAPH Pull In Switch (3) Off Drop Out GN2 SUPPLY On Switch DC Power OUTPUT VOLTHETER Off PRESSURE 0-50 VDC REGULATOR (R1) + LINE SWITCH PRESSURE GAGE (G1 FILTERS (F1 TEMPERATURE CHAMBER FILTER (F) TEMPERATURE INLET ADAPTER READOUT call HERMOCOUPLE . FIGURE 14

FORM 600-8-31 NEW 6-63